METAL INDUSTRY

VOLUME 37 | MAY, 1939 | NUMBER 5

Founded January, 1903 by
PALMER H. LANGDON
1868-1935

Publication Office:
116 John Street, New York

L. J. LANGDON
Publisher

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SUBSCRIPTION PRICES: United States and Canada, $2.00 Per Year; Foreign $4.00. Single copies, 20 CENTS. Please remit by check or money order; cash should be registered.

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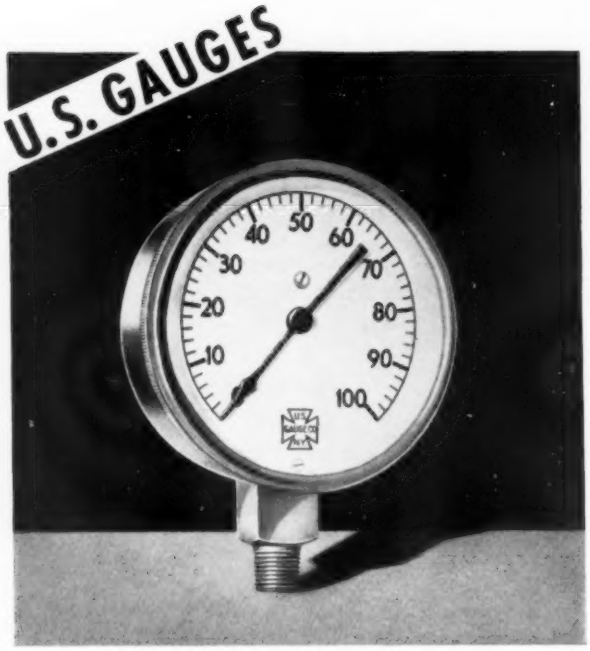

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METAL INDUSTRY
VOL. 37, NO. 5 FABRICATION · ASSEMBLING · PLATING · FINISHING MAY, 1939

Finishes and Metals at the World's Fair

THE brightness and sparkle of the World's Fair are due in a large measure to the clever use of new alloys and finishes. Chromium plated and oxidized fixtures and trim, copper, aluminum and stainless steel walls, paneling and columns present a brilliant spectacle that is a far cry from prosaic brick and painted wood of the past.

The developments of the past decade in organic finishing have been remarkable, and examples of progress are visible on every hand. Gleaming white enamels on refrigerators, washing machines and other appliances which withstand abrasion, chemical attack and sunlight, and colored finishes of surprising beauty and stability. Automobiles with synthetic enamel and lacquer finishes that should stir the soul of an artist. Metallic blues, greens, pearl finishes and warm deep hues of the spectrum.

A decade ago automobile finishes were expected to crack, craze, chalk, peel or decompose within a short time. The plating was usually rusted or spotted in less than a year. Not so today—the finishes are expected and do last as long as the life of the car.

A survey of instrument exhibits will show the new magnificent wrinkle finishes, brushed chromium, oxidized finishes and bright nickel which give long life to the instruments and at the same time enhance their beauty. Striking evidence of developments in alloys is to be seen everywhere. Stainless steels, corrosion resistant alloys, high strength aluminum alloys, copper alloys, die cast zinc parts of the most complicated shapes.

Pre-fabricated metal buildings with beautiful styling and of many designs, point the way to the homes of the future free from the dangers of fire, termites, earthquakes and rot.

The kaleidoscope of wonders of the World's Fair is not all of the things to come but is mostly of developments of the present, readily available to the public. The utility and esthetic value of engineering developments are greatly dependent on surface finishes and it is evident that the plating and finishing industry has kept pace with engineering progress.

Crystallization of Metals

In spite of the widespread knowledge of metallurgy, the understanding of the fracture of metals by fatigue is generally poor. The layman's description of the fracture of a part by fatigue is that "crystallization" of the metal has occurred, with either the idea that the crystals have grown to larger crystals or else new crystals have formed from an amorphous material.

While it is true that, in certain cases, grain growth may occur in metals on standing, such as in the case of lead, in general, no grain growth occurs even over the course of centuries. Fatigue fracture, or as it is erroneously called, "crystallization of metals", occurs as the result of repeated stresses below the elastic limit of the metal concerned. The breaking of wire by bending back and forth would not be true fatigue inasmuch as the elastic limit of the wire is normally exceeded in the bending process. The nearer the stress is to the elastic limit, the shorter the fatigue life, and therefore, when mechanized parts are to be designed for long life, they should be constructed with tensile strengths considerably above that of the elastic limit.

Repeated fractures of springs on devices have been observed where, at first, faulty manufacture or material were assumed to be responsible, but on analysis of the stresses, poor engineering design was the fundamental reason for the failure inasmuch as the springs were operating too close to the elastic limit.

Fatigue stresses may be applied by breaking, twisting, bending or pulling—resulting after thousands of cycles of stress, in slight movements of the atoms along certain crystallographic planes in the body of the crystals with, of course, no change in the crystal size itself. These slight movements in the atoms eventually result in a crack extending from the body of the crystal to the grain boundary with eventual fracture of the specimen.

The danger of failure by fatigue may be overcome by proper design to keep the stresses well within the elastic limit, by selection of materials with high fatigue life, by protecting the surfaces of the parts against corrosion and by preventing scratches and other surface defects which may lead to notch propagation.

Benzene, Benzine, and Naphtha

The use and designation of the two different organic solvents, benzene and benzine, are still somewhat confused in industry and because of the relatively high toxic nature of benzene in contrast with benzine, which is a relatively safe solvent physiologically, these solvents should not be used interchangeably. Benzene (or as it is sometimes called benzol) is an aromatic closed-chain type of hydrocarbon derived from coal tar, and is a close relative of toluene and xylene, which are solvents of considerably less physiological harm.

Benzene has better solvent powers than benzine and is approximately twice as costly as benzine. Benzene has disappeared almost entirely from the lacquer industry, but it is still being used in large quantities in rubber cements. Continuous use of benzene should be done only with full ventilation to remove the vapors.

Benzine (naphtha) is a hydrocarbon solvent of the straight chain type, is a poorer general solvent than benzene but because of its lack of physiological harm and relatively low cost, it has found extensive use as a cleaning material. Continuous contact of benzine with the skin may result in dermatitus, or cracking due to extraction of natural oils. The new synthetic rubber gloves, which have been made available to industry, may be used to protect the workers' hands. This new type of rubber withstands the action of benzine almost indefinitely.

It is unfortunate that the names of these two widely different solvents are pronounced the same, and the use of the term "benzol" in preference to benzene would eliminate the confusion which now exists.

The designation "naphtha" for almost any mixture of petroleum hydrocarbons boiling between the gasoline and kerosene ranges, is fraught with confusion. This problem has been further complicated by the appearance on the market of hydrogenated naphthas which are not true naphthas but are largely aromatic hydrocarbons.

Industry has adopted coined or trade names for special naphthas such as V.M. and P. Naphtha, Stoddard Solvent, Safety Solvent (naphtha with a flash point above 100°F.) and, therefore, since these names imply rather definite types of solvents, their use has much to offer in contrast with the indefinite term "naphtha".

Metal Spraying of Lead-Tin Alloys

By M. E. Lawrence

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A new gun for spraying molten, low-melting metals is described. Spray coatings using this type of gun may be used: for making non-conductors, conductive; repairing automobile bodies and fenders; duplicating patterns, temporary match plates, core boxes and repairing worn metal patterns in the foundry; duplicating master molds; making window signs; applying lead or alloy coatings to tanks; coating wood, cloth, etc. The fine duplication possible in the use of the sprayed coatings described, is illustrated by the duplication of finger prints or half-tones.—Ed.

Introduction

Metal spraying is a common term used to describe the process of spraying molten metal. Metal spraying can be compared with paint spraying in that both processes deposit material in a highly atomized state for the purpose of covering a surface. The paint spray gun uses compressed air to force the liquid paint by pressure and suction through a nozzle to break it up into a fine mist traveling at a high velocity. The metal spray gun acts in generally the same way except that it must also melt the cold metal which it uses. The molten metal then is broken up into a fine mist by the use of air pressure or suction and forced forward at high velocity.

Further comparison would be that paint spraying is only for the purpose of covering a surface for decoration or corrosion and weather resistance, while metal spraying is used not only to cover surfaces for decoration and corrosion resistance but also as a putting-on tool to fill up holes, dents, and crevices to bring them back to original levels.

Equipment for Metal Spraying

The equipment used for metal spraying is both complex and simple depending upon the type used and the job to be done. In all cases, it is efficient, fast, and economical. In all types of equipment, compressed air is used at varying pressures as the motivating force. Since the metal must be melted, a source of heat energy is required. Various means are used for furnishing this heat including oxygen and acetylene, electricity, alcohol and gasoline.

The field of metal spraying is divided into two classes; high melting point metals (copper, brass, aluminum, iron and various steels), and low melting point metals (lead, tin and all alloys with a melting point of 1000°F. or less.) The equipment for metal spraying also is divided into the high and low melting point classifications. Metal spray guns using oxygen and acetylene for heat will melt and spray both the high and low melting point metals, but are used generally for the high melting point metals due to a larger initial equipment cost. The metal spray guns used only in the low melting point field are heated by blow torches burning gasoline or alcohol or by electricity.

The oxygen-acetylene metal spraying equipment is composed of air-operated turbine control valves for compressed air, oxygen and acetylene and a compound nozzle for burning the fuel. The metal to be sprayed is used in wire form and drawn by the turbine mechanism into the nozzle and is melted and sprayed.

Figure 1

Gun for spraying tin-lead alloys.

Electrically heated metal spray guns have been used mostly in the automotive body and fender repair shops. In this type of gun, metal rods of small diameter are fed into a well with a hot spot at the bottom where the metal melts and drops into an air stream which breaks it up into fine

particles that form the spray. The temperature is thermostatically controlled.

New Type of Spray Gun

The types of metal spray guns described above operate on the principle of melting the metal in the air stream or dropping molten metal into the air stream. These methods have operated successfully, but now a new design of metal spray gun has been introduced which embodies certain new and advantageous principles. The metal is melted in a crucible and a reserve of molten metal maintained for steady, constant service. The metal is then siphoned through a stainless steel orifice into the air stream thus giving a very fine mist spray. A control needle is used so that the amount of metal sprayed may be instantly adjusted from practically nothing up to two pounds per minute and turned on or off. The heat is furnished by an efficient gasoline blow torch with full adjustment of flame so that just the right amount of heat can be used to keep the metal properly molten. This type of metal spray gun has made possible many spray applications hitherto impracticable such as fine, accurate duplication, dental work, metal fingerprinting, numerous art examples, etc. and at the same time it is a heavy duty production tool.

Characteristics of Sprayed Metal

Certain characteristics of sprayed low temperature metals are important as compared to the same metals when poured and cooled. The sprayed metal has a greatly reduced tensile strength, a comparable compressive strength, fair but reduced ductility, and is somewhat more porous when examined microscopically. The bond of the metal is mechanical since it is composed of many globules in a plastic state hitting and flattening out thus filling all crevices and interlocking as they harden. On untinned surfaces, the bond of the sprayed metal to the base metal is purely mechanical and the holding quality is entirely dependent upon the roughened condition of the base metal. On tinned surfaces, a chemical bond is utilized.

Figure 11.
Sprayed cavity for pattern duplication.

In view of the above characteristics, it is desirable to discuss the advantages and disadvantages of sprayed metal, its separation and adhesion, and the types of work to which it is applicable.

Sprayed metal is not only advantageous but also unparalleled from a cost and utility standpoint on many types of work because it is deposited cool and does not warp or set up stresses in the base metal, it is quickly applied, the amount of metal applied is easily controlled to avoid waste, and unnecessary finishing cost, a metallic surface is given to non-metallic objects for electrodeposition, it can be applied in inaccessible places, it can be used on jobs where poured or paddled metal cannot be used due to heat given off, its use for corrosion resistance is inexpensive and rapid, and it has no expansion or contraction so is of great value on jobs where accuracy is essential.

It is well to note here that sprayed metal does not and cannot economically compete with other methods on small or medium sized parts that can be easily handled in galvanizing, tin dipping or plating baths. It is advantageously used where articles are large or heavy, thus necessitating special equipment, or of special shape or design and as a salvage or maintenance tool. Many specific uses are listed later.

The separation or adhesion, as desired, is of prime importance and success depends entirely upon proper preparation of the base metal.

Securing Adherent Coatings

Adhesion is of two general classes, the mechanical and the chemical bond. The mechanical bond depends entirely upon a porous or well-roughened condition of the base material so the sprayed particles can enter cavities and crevices in which to lock themselves. All metal surfaces must be properly prepared, be thoroughly clean and free of oil or grease, and should be sprayed as soon as preparation is completed in order to reduce oxidation. Sandblasting or metal grit blasting is generally considered as the best method on all flat or large surfaces. If sand is used it must be sharp, preferably a No. 16 sharp silica sand. Ordinary sand will merely peen the surface and not roughen it so is of no value. Wood or plaster surfaces are often sufficiently porous to give good adhesion but should be subjected to a light sandblast for best results. Regardless of the base material, the surfaces must be rough for a mechanical bond. Certain metals such as steel or aluminum can be cleaned and then tinned with commercial cold or warm tinning compounds which are furnished by the various metal spray manufacturers. The instructions are simple and come with the compound. The bond or adhesion obtained in this fashion is excellent as shown by the fact that metal spraying of body solders is in common use by automobile body repair shops.

Methods for Separating Coating and Base Metal

Separation of the sprayed metal from the base material is essential on many types of work such as pattern duplication, art work, dental impressions and reproductions of all sorts. Good separating qualities are easily obtained whenever the base material is properly processed. A smooth surface is essential and all porous materials should be given light coatings of varnish or shellac to fill up pores and given a light film of oil. All non-porous materials having a smooth surface should be coated with a light film of oil. On plaster, a thin film of water wax is a good separator. A small amount of ester gum mixed in a solution of methyl acetate makes a good surface when spraying upon wax. There are other methods of separation used and the best method for any particular job can be determined by following the principle of preparing the material to give it a smooth, non-porous surface and then coating with a thin film of liquid that does not become tacky and grip the two materials.

Figure III.
Baby shoes coated with metal by the use of a metal spray gun.

Automobile Body and Fender Rebuilding

One of the largest uses for lead-tin alloy metal spraying is automobile body and fender rebuilding. The dented part is straightened where possible and the surface is sanded with a wheel until the base metal is clean, the surface is then tinned with a tinning compound and rubbed until it is bright. The tinned surface is then sprayed with 30-70 body solder until built up above the original level. The metal is then brought almost to level by filing and is then sanded until smooth. The surface is now ready for refinishing. This method is rapidly superseding the old method of paddling the solder because of the great time saving of application and finishing.

Making Pattern Duplicates, Match-Plates, etc. in Foundry

The pattern shop of a foundry presents many uses for metal spraying, such as the making of duplicate patterns, temporary match plates, temporary core boxes and repairs on worn metal patterns. It is often necessary to make extra patterns for short runs because casting from a single pattern is costly, yet permanent match plates are too expensive. By the use of metal spraying, temporary match plates are easily and quickly made. A shell of metal is sprayed over the master pattern of wood, plaster, soap, or wax and this shell is backed up with plaster for strength. The metal surface is then covered with a thin film of oil and is used as a female. Spray a shell about 1/32" thick into the female shell and back it up with plaster. Inserts are set in the plaster and the surface levelled. These inserts are used to anchor the pattern to the match plate. As many patterns can be put on the plate as desired.

Miscellaneous Uses of Metal Spraying

The art field also presents many users for metal spraying. Any master or original without undercuts can be sprayed to get a female impression. The metal is sprayed into this female and backed with plaster. The duplicate of the master, is now made with a metal face and ready for any plating or oxidizing process. Rubber molds of objects can be used for duplication work. If the article is to be plated, the inside surface of the metal must be sealed

Figure IV.
Filling a fender dent by metal spraying.

Figure V.
Metal sprayed wood turnings.

with varnish before the plaster is poured. Beautiful bronze plaques can be made by copper plating and oxidizing in a liver of sulphur or other oxidizing bath and then brushing the highlights. The objects should then be lacquered.

Attractive window signs and displays are made by spraying into stencils on the inside of the glass and then removing the stencils. The metal can also be painted before the stencil is removed.

In the field of corrosion and contamination prevention sprayed metal is often used. Corroded and rusted tanks or vats are sandblasted and then lead sprayed. The life of such articles is then greatly increased. Many types of food and milk containers can be sprayed with tin to effect reclamation savings. Thicker coatings are possible by spraying than by tin wiping. Structural work of all sorts can be sprayed with lead in order to resist corrosion and acid fumes.

Metal spraying on wood is often desirable for decorative or fire resisting coatings. Sandblasting to roughen the surface is the only preparation necessary.

Lead or tin when sprayed on wood reduce its susceptibility to changes in moisture content and dimensions due to atmospheric humidity changes.

Metal spraying is often used for special metal decorations and designs on cloth, especially in moving picture and stage costume and curtain work. No preparation of the cloth is necessary and the metal is merely sprayed through a stencil laid on the cloth. Another novelty application of metal spraying is that of metal fingerprinting. The metal is sprayed on the fingers and then peeled off to give an exact female replica of the fingerprint.

Within the past few years a process for spraying babbitt into bearings has been perfected. It is not necessary to anchor or tin the sprayed babbitt to the box, and lifting of the babbitt or blowholes are eliminated. This process makes extra thin linings much less expensive. Bronze bearings can be sprayed with a thin babbitt lining and thus improve the bearing surface and reduce heating. The bearing boxes should be sandblasted and sprayed with a thin coat of tin before spraying the babbitt.

Figure VI.
Sprayed metal reproduction of finger prints.

In general, lead is used where protection from corrosion or acid fumes is needed and tin is used where foods are to be protected from contamination.

The cost of metal spraying of lead on average large surfaces is about $4\frac{1}{2}$c. per sq. ft. for light coatings. This includes labor and fuel but not metal.

Following are some of the articles being sprayed with lead for corrosion protection, fire protection, or decorative purposes: wood carvings, wood signs, wood furniture and inlays, plaques, statues, art objects, parapets, coping, cornices, wood store fronts, wood shingles, garden furniture, structural iron and steel work, tanks and vats, blowers subject to fumes, pickling rooms, sludge tanks, interior of oil tanks and cars and copper bus bars.

Tin has been sprayed on the following for contamination protection: milk coolers, separators, pasteurizers, food tanks, glass-lined tanks, dryers and filters, evaporators, food molds, concentrators, yeast fermentors, fruit juice containers, and brewing tanks.

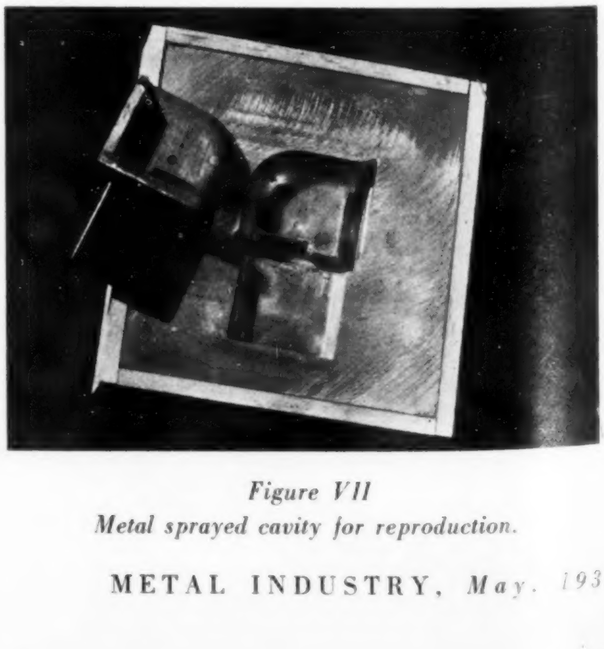

Figure VII
Metal sprayed cavity for reproduction.

The Testing and Stripping of Zinc and Cadmium Electrodeposits

By Dr. B. Egeberg and Nathan E. Promisel

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This is the concluding part of the article which was published in the April issue. Microscopic and dropping methods for measuring zinc and cadmium coatings are described. The Preece test, hydrogen peroxide-acetic acid test, magnetic tests and the chord method for measuring thickness of coatings are considered. Methods are also given for testing zinc and cadmium coatings for porosity, adhesion, hardness, ductility and wear.—Ed.

(1) Microscope Method. The principles involved in this method have been previously discussed. It is important to point out in the case of zinc and cadmium, however, that it is no easy task to prevent the flow of the coating during polishing of the specimen, even though it is first plated with a harder metal like copper or chromium. However, in spite of the fact that some skill is required to obtain satisfactory results, it is possible to successfully utilize this important method of examination. Kenworthy recommends molding the specimen in Bakelite (see previous articles by the authors) or, in the case of sheets, clamping one or more specimens between pieces of steel 2 mm. thick by a nut and bolt passing through the centers. A clamp preferred by the authors is illustrated in Fig. 4. After the routine treatment with a file, emery paper and polishing wheels, the specimen may be advantageously etched 5 seconds in a solution containing 50 grams of chromic acid and 4 grams sodium sulfate per liter of water. At 250 magnifications, good measurements can be made of the thickness of coatings or their component parts.

(2) Dropping Method. In this method, drops of corroding solution fall at a fixed rate upon the surface being tested until the basis metal is exposed. Either the number of drops or the time consumed may be measured and is proportional to the thickness of the deposit. Thus by always applying fresh reagent, the rate of dissolution of the zinc or cadmium is kept nearly constant.

The latest form of this test, as modified by Hull and Strausser, employs a dropping rate of 90 to 110 drops per minute at temperatures between 70 and 90°F, the time of stripping being noted. The following solutions are recommended:

For electroplated zinc from acid or cyanide solutions, with or without traces of mercury:

Ammonium nitrate	100 grams per liter
Concentrated nitric acid (sp. gr. 1.42)	55 cc. per liter
For hot-dipped zinc coatings:	
Ammonium nitrate	100 grams per liter
Concentrated hydrochloric acid (sp. gr. 1.18)	75 cc. per liter
For cadmium deposits:	
Ammonium nitrate	110 grams per liter
Concentrated hydrochloric acid (sp. gr. 1.18)	10 cc. per liter

In all cases, 0.00001" of metal are removed per second, with an accuracy within 15 percent. A convenient method of conducting the test uses apparatus consisting of a

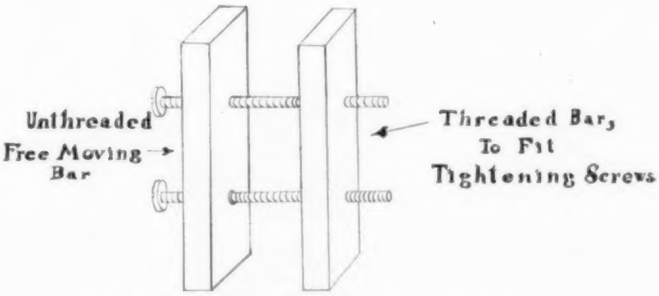

Figure IV. Clamp for holding microscopic specimens.

separatory funnel connected with rubber tubing to a stop-cock drawn to a tip as in a burette. The specimen is placed under the tip, inclined at an angle of 45°, in a dish to collect the reagent. Before the test, the upper stop-cock is fully opened and the lower one adjusted to give the required drop speed. The upper one is then closed, the specimen put in place, and the upper stop-cock then opened again until the bright bared steel shines through the stained coating.

(3) Jet test. This method, due to Clarke, is similar to the dropping test except that instead of using drops, a steady stream of reagent is employed. The jet is adjusted in size so that about 10 cc. of solution are delivered in 30 seconds. The apparatus is similar to that described above except that a reservoir of reagent is attached to the burette or separatory funnel to maintain a constant "head" (10

inches to tip of jet), which is important. The preferred solutions for electrodeposits are:

For cadmium on steel and copper:

Ammonium nitrate	17.5 grams per liter
Hydrochloric acid (sp. gr. 1.16)	1.8 cc. per liter

For zinc on steel:

Ammonium nitrate	70 grams per liter
Hydrochloric acid (sp. gr. 1.16)	7.0 cc. per liter

These solutions ordinarily remain unchanged over long periods of time (4 months). The end-point is indicated by the contrast between the steel and the stained deposit. The crystalline structure of the deposit has no marked effect and the accuracy is within 15%. The following correlations are available:

Temp. °F	Seconds for Penetration of 0.0001″ cadmium	Seconds for Penetration of 0.0001″ zinc
75	9.7	4.1
80	9.0	3.8
85	8.4	3.6

(4) The Preece test. In this test, the zinc-coated iron specimen is immersed in a copper sulfate solution and examined at 1 minute intervals for adherent bright red copper. The number of dips required is therefore a measure of the thickness in that particular area. The principle is based on the theory that as long as no iron is exposed, no adherent copper will be deposited. When iron is exposed, it acts as a cathode with respect to the zinc which must be adjacent to it, depositing adherent copper. After each one minute dip, therefore, the specimen is washed in running water and rubbed lightly before being examined. The specimen should be thoroughly cleaned between dips with a mild abrasive. The solution recommended (sp. gr. 1.170) contains 330 grams of crystalline copper sulfate per liter of distilled water, neutralized to a pH of 3.3 with cupric hydroxide, and maintained at a temperature of 60°F. Agitation of the specimen in the solution should be avoided since it leads to inconsistent results.

The Preece test is open to certain objections. In the first place, premature end-points (adherence of copper before exposure of steel) are possible due to the formation of plastic material on the metal surface during the test. This is least apparent with electrodeposits but in many cases can be eliminated by thoroughly rubbing the dried specimen with a soft abrasive such as a pencil eraser between immersions. A preliminary dip in 2% sulfuric acid for 15 seconds is also claimed to be helpful. Delayed end-points are also possible, in which case the appearance of the bare steel must be used as an end-point. Most important, however, is the fact that the rate of dissolution of the coatings varies with the manner in which they have been prepared. For example, for equal thickness, the time of immersion to withstand the same number of dips for the various coatings would have to vary as follows: electrodeposits, 60 seconds; sprayed zinc, 55 seconds; hot-dipped zinc, 80 seconds; galvannealed coatings, 120 seconds. Finally, the test is not suited for thicknesses less than 0.0005″ (or better, 0.001″) because the small number of dips leads to a possible high percentage error and an adherent coating of copper is not always obtained, since a thin deposit may disappear from such a large area, that the "cell action", described above as necessary for adherence, cannot take place. In spite of all this, the Preece test is found very useful, and will be found satisfactory for distribution tests on electrodeposited and hot galvanized coatings and for thickness tests on electrodeposits over 0.001″ thick.

(5) The hydrogen peroxide-acetic acid test is used only with electrodeposited coatings on steel and assumes uniform removal of the coating. Actually, it depends to some extent on the method used in plating the specimen. A solution containing 140 cc. of 3% hydrogen peroxide, 19 cc. of glacial acetic acid, and water to make 1 liter is used at 200°F, in which the specimen is immersed. The time for the appearance of the first rust is measured and correlated through a calibration curve, previously determined, with the weight of plate.

(6) The electrochemical method of Britton previously described can also be used, of course, to indicate local thickness of zinc on steel and is, in fact, especially valuable for this purpose.

(7) Magnetic tests, limited to deposits on iron and steel, have been developed and are particularly desirable since they are non-destructive of the article or coating. Two types have been studied. The first, developed by A. Brenner at the National Bureau of Standards, depends on the decrease in the attraction of a permanent magnet for the steel basis metal when the two are separated by the zinc or cadmium (or, in general, non-magnetic) deposit, a spring balance being used to measure the attractive forces. Such an instrument is now available in the market. A second type, manufactured by the General Electric Co. for heavier coatings and described by Tait in England for thinner coatings, involves the use of a miniature transformer in a gauge head, with a magnetic circuit which is closed by the steel basis metal, through the coating. The reluctance of this circuit is affected by the thickness of the non-magnetic coating, the latter being measured then in terms of electric current rather than attractive force as in the first type described above.

(8) Chord Method. This method is said to be accurate within 10% and is useful for coatings over 0.0002″, although an extension of this method has been announced by Mesle which will allow thinner coatings to be tested. The original method, described in previous articles, depends on the width of the cut produced by just filing through the coating to the basis metal.

Before leaving the general subject of the thickness of zinc coatings, a brief comparison of methods, due to Meyer, may be given here. For electrodeposited coatings, there is excellent correlation between the methods of the microscope, hydrochloric acid-antimony trichloride, and Hull and Strausser. The Preece test is good for thickness measurements above 0.001″ and for distribution tests below that.

With sherardized coatings, the Preece test is not good due to variation in reaction rate with the various iron-zinc alloys formed and delayed end-points. If the presence of iron is taken into account, the microscope gives results within an accuracy of 10%. The only reliable method for the weight of zinc consists of stripping the coating in hydrochloric acid and then analyzing it for zinc.

In the case of hot-galvanized coatings, the electrochemical and microscope methods are good for determining the relative thicknesses of the three alloy zones formed. Each zone has a different reaction rate in the various test solu-

tions. A correction for iron must be introduced if the microscope is used to determine total weight of zinc. The Preece test and microscope are good for distribution tests, and stripping followed by analysis is the only good test for the amount of zinc present.

F. Testing for Adhesion to the Basis Metal

The adhesion of cadmium and zinc electrodeposits to the basis metal is intimately tied up with the corrosion resistance of the specimen, effectiveness in the latter requiring a high degree of the former. One recent development especially brings up the question of adhesion, namely, the continuous zinc plating of steel wire, which of course is to be eventually subjected to a variety of working conditions.

In general, tests similar to those described in earlier articles may be used here also. They involve the application of surface friction or mechanical distortion to the deposit, including therefore bending, hammering, Erichsen cup testing, burnishing, etc. Certain tests will suggest themselves, such as the use of sharp bending and winding tests on plated wire.

G. Hardness, Ductility, and Wear Tests

Zinc and cadmium are so soft that penetration hardness tests, like Brinell, must be applied with extreme caution to avoid the effect of the underlying hardness of the basis metal. The method employing both indentation and scratch, previously described by the authors, may advantageously

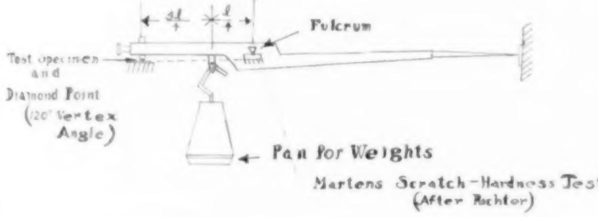

Figure V. Scratch hardness tester.

be applied here. O'Neill has recommended for cadmium, for example, a hemispherical diamond indenter of 1 mm. diameter under a load of 0.115 kg. This is suitable for cadmium deposits of 0.00025" in thickness.

Very recently, a modification of this type of test has been suggested. A diamond point, cut to an angle of 120°, is used and the load is varied until a predetermined scratch width is obtained. The load necessary to obtain this width is then used to express the hardness of the coating. This method has the advantage that a scratch width can be chosen (such as .0001") which will be satisfactory even for the thinnest deposit to be tested, leaving as the only variable the applied load. In the other methods of applying this type of test, the load was arbitrarily chosen depending on the coating under consideration, and then the scratch width was measured, leading either to a lack of uniformity in expressing the results for a variety of specimens or to the use of a scratch not always appropriate to the coating.

A sketch of the apparatus used in the above is given in Fig. 5.

Weights in the order of 0.01 grams are convenient for use in loading.

In connection with wear tests, discussions of tests of other metals also apply here. The carborundum test has been especially mentioned for soft metals. This consists of blowing carborundum powder under standard conditions against the specimen until a circle of about 2 mm. diameter is worn through. The weight of carborundum used to accomplish this is used as a measure of the wear resistance.

In connection with the testing of ductility and brittleness of the deposits, a routine associated with the Britton electrolytic stripping test described above has been arranged. It is particularly applicable to wire and depends on testing for thickness of coating after subjecting the wire to a standard wrapping test. About 12 inches of wire are wrapped around a mandrel of diameter 4 to 8 times the diameter of the wire, depending on the ultimate use of the wire. The speed of wrapping should approximate one turn per second. The wire is then unwound and thoroughly straightened, and a six inch portion is removed for testing electrolytically as described above. If the iron base is exposed in this test before a predetermined minimum time, the ductility of the sample is considered unsatisfactory.

I. Testing for Porosity

As has been intimated previously, the porosity of zinc or cadmium coatings does not assume the great importance held in the case of other metals ("cathodic coatings"), because these two metals protect ferrous basis metals from corrosion by electrochemical "sacrificial" methods and not by the purely mechanical "screening and shielding" methods of other metals such as nickel. In the latter cases, the metals are noble to iron, so that in the presence of a corroding medium the iron corrodes in preference to the electroplate, for example nickel, and in fact such corrosion is accelerated by the presence of the nickel. It is thus of prime importance that the noble metals be relatively pore-free, so that no corroding materials can reach the iron. In the case of cadmium or zinc deposits over iron (steel), the latter is the more noble so even if corrosive media reach the iron through pores and other small, nude areas, it is the cadmium or zinc that preferentially dissolves. Obviously, however, it is desirable to have even these metals relatively non-porous so that they are not consumed too rapidly by their "sacrificial" protection, especially since the uncovered area so protected is definitely limited. Furthermore, under some conditions, notably in the case of zinc coatings exposed to marine atmospheres, the relative protective ability is decreased due, in the case of zinc, to the formation of a thin film of basic zinc chloride, which, however, also reduces the rate of corrosion. The following tests will therefore be found very helpful.

(1) In the case of high purity zinc coatings, pores are made evident, and the importance of having non-porous coatings indicated, by immersion of the specimen in dilute sulfuric acid. Due to the high over-voltage of hydrogen at a zinc surface, if no pores are present attack of the zinc stops quickly. If pores are present, exposed iron offers cathodic areas of low over-voltage and hydrogen is evolved, with corresponding dissolution of the zinc. If, however, an ample supply of oxygen is maintained at the surface of the zinc, attack proceeds in both cases.

(2) The popular ferricyanide porosity test, so nicely

applicable to iron coated with nobler metals and previously discussed, obviously cannot be used as such in the case of cadmium and zinc, since the iron is prevented from corroding as discussed above and the deep blue coloration of ferrous ferricyanide (Turnbull's Blue) indicative of pores cannot therefore be formed. Useful modifications of this test have been suggested, however, chief of which is the method by which the specimen being tested is made anodic by application of an external electric potential. In this way, both the zinc and the iron are corroded, and the tell-tale blue is formed at the site of exposed iron, that is, at pores, pinholes etc.

One method of accomplishing the above consists of connecting the test sample to the positive terminal of a storage battery and two dry cells connected in series. The specimen is then covered with the test solution, on the surface of of which is placed a metal plate connected to the negative terminal of the battery. Instead of using a solution which, when jelled, cracks in a few weeks, specially prepared paper may be employed. This is placed over the specimen (which must now be relatively simple in shape) and is rolled into good mechanical and electrical contact by means of a brass roller (with a wooden handle) connected to the negative terminal of the battery. The test solution recommended contains, per liter: 60 grams, sodium chloride; 6 grams, potassium ferricyanide; 30 grams, agar-agar; 300 cc., ethyl alcohol; remainder water. The prepared paper is made as follows: a solution of 60 grams sodium chloride and 6 grams potassium ferricyanide in 500 cc. water is heated to almost 105°F and poured on 15 grams of gelatine previously soaked in cold water for 15 minutes. The warm gelatine solution is then applied evenly over baryta paper which is then chilled on ice and finally cooled slowly. For use, the paper is soaked for a few minutes in water or in a 3% potassium ferricyanide solution.

In a similar procedure, employing a test solution with a platinum cathode, the solution consists of 40 grams potassium ferrocyanide and 1 gram magnesium sulfate in 1 liter of water. It is claimed that a short exposure in this test corresponds to about 5 days in a salt spray and that iron and iron-zinc alloy inclusions in the coating do not give rise to the blue coloration.

Two chemical tests for porosity in zinc, not employing external batteries, have also been suggested. In one, potassium ferricyanide is used together with oxalic acid and hydrogen peroxide, a combination presumably capable of giving the blue color at the sites of pores. In the other test, a solution containing about 0.1 gram potassium permanganate per liter of water is used. Where the iron is exposed, black manganese dioxide is formed.

A test for porosity in cadmium is effected by immersing the specimen in a 20% solution of sodium hydroxide maintained at about 175°F. No attack occurs whether pores are present or not. A piece of zinc is then immersed in the solution and connected externally by wire to the cadmium plated iron. The zinc is attacked and hydrogen is liberated as streams of bubbles at the sites of pores in the cadmium coating. These streams may be counted to give a semi-quantitative measure of the porosity. The cadmium specimen or its porosity is not affected in this test. This test is an adaptation of the Walker test for porosity in zinc, where the hydrogen is again given off at the discontinuities in the zinc coating but is not recommended for this purpose because the zinc itself is attacked. Even in the case of cadmium, this test has been criticized on the basis that streams of hydrogen can, under some conditions, be produced even when solid cadmium is used to replace cadmium-plated steel.

A better chemical porosity test for cadmium is one used by Clarke in a study of cadmium coatings on steel. In this test, the degreased specimen is immersed in a 1% solution of hydrochloric acid for a few minutes and the formation of hydrogen bubbles at discontinuities noted. The coating is not destroyed.

Analyzing Spectrographic Plates

Analyzing spectrographic plate by use of microphotometer. At the rear is shown assembly of galvanometer in "Julius Suspension". By this method, vibration is eliminated by shock absorbers in oil and there is a glass housing for freedom from dust. Dials are for checking current for lamp which supplies light of uniform intensity. Light beam passes through plate in turn being focused on photoelectric cell which in turn gives relative galvanometer reading.

Drag-Out Losses from Plating Solutions

By Philip J. LoPresti

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Philip J. LoPresti

Various methods for overcoming "drag-out" losses from plating solutions are described. Design of plating racks, recovery tank systems and calculations on "drag-out" losses are considered. The loss from nickel solutions by "drag-out" was found to decrease with a lowering of the surface tension of the solution. —Ed.

Introduction

In the control of electroplating processes the reduction of losses from "drag-out" is a major problem. The importance of controlled "drag-out" is recognized in plating precious metals. The trend today in large plating establishments is to study and reduce the "drag-out" losses from the more common solutions such as copper, nickel, cadmium, tin, etc. One manufacturer has found that in a large full-automatic bright nickel solution, the "drag-out" loss for a year's operation was equivalent to three times the capacity of the tank! The amount of solution "drag-out" depends on the kind of rack, shape of article, method of racking, surface tension and time allowed for draining of solution. The usual method of recovering the solution "drag-out" as in chromium plating is to save the first rinse and use this for replenishing the plating solution. In plating precious metals, the first rinse is refined in the plant or sent to the refiners for recovery. If this problem of "drag-out" is studied with the previously mentioned facts, much can be done to reduce losses.

Design of Plating Racks

For minimum "drag-out", the rack should be streamlined. All edges should be rounded. The framework soldered or preferably welded so the solution can not trap around sections of the framework. The hooks should be placed so that the work can drain easily. Finally and most important, the rack should be rubber lined and kept in good condition so that ease in rinsing can be assured.

Usual Method of Rinsing for Recovery of Solution in Precious Metal Plating

The usual method of rinsing after plating is to immerse the rack in a still water tank. The plated material is rinsed in this until the plater decides to refine it by his own methods or sends this rinse solution to the refiner. In either case, there is much waste, because, as more work is rinsed in this tank, it tends to become more concentrated and eventually the rinse can contain more precious metal than the plating solution. By this method, precious metal is constantly removed from the first rinse and thrown away in the final rinse. In one case, a rinse from an immersion gold solution was accidently used by a plater and he produced two times more work from his rinse than he ordinarily plated from a new solution. This method of recovery is wasteful and can be controlled to a small extent by analyzing the rinse and refining when the value recovered is worth while.

Recommended Method of Rinsing for Recovery of Plating Solution

A. In this method the rack of plated material is hung in an empty tank next to plating tank and solution allowed to drain as long as possible.

B. This method has been found to be the most efficient. In this method, the rack after plating is hung in a spray rinse and in the case of full automatic plating solutions, the work passes through a number of spray rinses. In these rinses, the idea is to use the most pressure with the least water. In this way, the solution is only slightly diluted with water and also the most possible amount of solution is removed. In full automatic installations, the solution from the spray rinses is pumped back to the storage tank or directly back into the plating tank. This method is very efficient and if the correct amount of pressure and number of rinses is used, most of the plating solution can be recovered. By noting the following examples, interesting facts are noted about "drag-out".

If 100 cc. of nickel solution are lost by "drag-out" by each rack, and 400 racks are plated per day from a tank of 200 gallon capacity, the total "drag-out" is:—

100 x 400=40000 cc.=10.6 gallons solution.

Approximate cost of bright nickel=$0.50 to $0.75 per gallon

Total Cost=$5.00 to $7.50 per day

If we take this 10.6 gallon "drag-out" from this tank and a still water rinse of 100 gallons is used, then the first day should contain 10.6 gallons bright nickel solution or contain 0.1 volume of plating solution. If 10.6 gallons is the "drag-out" from the still rinse to the final rinse, then the still rinse will lose 0.1 of 0.1 or 0.01 the concentration of solution. This concentration of 0.01 will be lost daily if the still method of rinsing is used. Naturally this loss by "drag-out" of still rinse will be in proportion to the value of the solution. In the study of the relation of surface tension to "drag-out", the following figures were noted.

A flat piece of nickel plated brass strip 1" x 2" was used as the test piece. This strip was immersed in cold nickel solutions of known surface tension measured with a stalagmometer. After this piece was thoroughly wet with solution, it was allowed to drain for 10 seconds. Then the piece was immersed in a beaker containing distilled water. This solution was analyzed for nickel content and this figure used as the relative amount of solution remaining on test piece or the "drag-out".

Test	Surface Tension of Test Solution	Nickel "Drag-Out"
No. 1	69.7 dynes/cm.	.0535 grams
No. 2	35.6 dynes/cm.	.0212 grams
No. 3	26.9 dynes/cm.	.0428 grams
No. 4	24.8 dynes/cm.	.0322 grams

This test indicates that as the surface tension of the nickel solution is lowered the test piece will rinse more thoroughly during the time allowed. If conditions are the same, these results should also hold true in actual practice.

The purpose of this paper has been to show the importance of "drag-out" and the losses occurring by wasteful rinsing of plated material.

Preventing Oxidation and Tarnishing of Copper and Its Alloys*

By G. J. Thomas, Ph.D., and L. Price, Ph. D.

The following brief article describes the results of some further original work on the oxidation and tarnishing of copper and its alloys undertaken by the authors at the Goldsmiths' Metallurgy Laboratories at the University of Cambridge. The published researches of Dr. Price and Dr. Thomas have aroused considerable interest because of the immediate practical interest of their results for the industry.—Ed.

In earlier papers [1, 2] we have established the conditions under which metal surfaces may be rendered resistant to the action of oxygen, hydrogen sulphide or any other gas which attacks the metal directly. Corrosion phenomena involving local cell formation were not considered. It was shown that metals only became resistant to further attack when covered with a film of high electrical resistivity, and alumina, beryllia and silica were recommended for this purpose. It was demonstrated that films obtained by heating in air silver or copper alloys containing aluminum, beryllium or silicon consist, not of pure oxides, but of alumina, beryllia or silica, contaminated by silver or copper oxides.

In order to obtain pure films of alumina, beryllia or silica upon the surfaces of silver or copper, two methods have been developed:

(1) An alloy containing a small amount of aluminum, beryllium or silicon was heated in an atmosphere, containing such a small quantity of oxygen that only the baser elements were oxidized. The atmosphere used for this purpose consisted of hydrogen containing 0.1 mm. pressure of water vapor and was obtained by passing hydrogen through a 4 weight per cent solution of sulphuric acid.

(2) By cathodic treatment of silver in a solution of a beryllium salt containing sufficient ammonia to bring the pH to 5.8.

In this way, great improvements have been made in the resistance of silver to tarnishing and of copper to oxidation. For instance, if the parabolic law is assumed to hold, it was shown that, in agreement with theory, copper covered with a film of cuprous oxide oxidizes about 200,000 times as quickly as copper covered with an equally thick film of alumina. For copper covered with a film of beryllia the factor should be even greater.

These methods have now been applied to other problems.

The Tarnishing of Copper

(a) The tarnishing of copper-aluminum alloys is of some interest in view of their use as household utensils. In Fig. 1 are shown three spoons made from an alloy containing 95 per cent copper and 5 per cent aluminum.

Spoon B was tarnished for 30 minutes immediately over a solution of ammonium sulphide (100 c.c. of commercial solution per liter); it showed interference colors within about 5 seconds.

Spoon C was heated at 500°C. for 20 minutes in an atmosphere of hydrogen containing 0.1 mm. water vapor in order to form a thin film of alumina upon the surface. It was

*Reprinted from The Metal Industry (London) 54, 189, (1939).
1. L. E. Price and G. J. Thomas, J. Inst. Met., 1938, 63, 253.
2. L. E. Price and G. J. Thomas, J. Inst. Met., 1938, 63, 357.

then submitted to the same tarnishing atmosphere as B but remained unchanged.

Spoon A did not receive any intentional tarnish treatment.

A *B* *C*

A—Untreated spoon. B—Spoon exposed over ammonium sulphide. C—Spoon heated in H_2 and steam and given same exposure to $(NH_4)_2S$ as B.

Fig. 1—Tarnishing of copper-aluminum alloy (95% Cu, 5% Al).

Although the specimen was kept in a separate test tube between preparation and photographing, except when examined, the untreated spoon shows a marked tarnish.

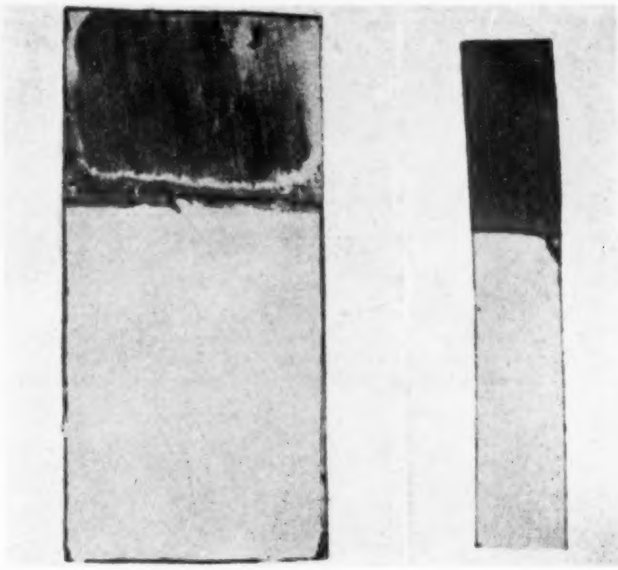
(b) Preliminary experiments with a copper alloy containing 2½ per cent beryllium have shown that a considerable resistance to tarnishing by ammonium sulphide solution can be developed by the selective oxidation of the beryllium in these alloys by a process similar to that used for the copper-aluminum alloy spoon.

(c) The tarnishing of copper can also be almost completely prevented by electrolytic deposition of a film of beryllia upon the surface.

In Fig. 2a is shown a sheet of copper abraded with emery paper Hubert 1F, which was partly immersed in a solution containing 3.4 grams per liter beryllium sulphate with sufficient ammonia added to bring the pH to 5.78. On being made cathodic with a current density of 160 micro-amps./cm.^{2} for 8 minutes, a film of beryllia was deposited over the lower portion and prevented it from tarnishing on subsequent exposure to the atmosphere containing ammonium sulphide already described. During deposition, the same rise of potential occurs as during the treatment of silver. Full details of the method will be published shortly.

The Oxidation of Copper

By electrolytic deposition of beryllia, copper may also be made more resistant against oxidation.



a *b*

Fig. 2—(a) The prevention of the tarnishing of copper by the electrolytic deposition of beryllia. (b) The prevention of the oxidation of copper in air at 300°C. by the electrolytic deposition of beryllia.

Fig. 2b shows another sheet of copper part of which was treated electrolytically as described previously and then heated in air for 30 minutes at 300°C. Although the untreated portion had passed through the entire range of interference colors, the treated portion appears quite unchanged. However, continued heating did cause some oxidation of the protected area.

Conclusion

These experiments indicate that the theories developed during our work on the tarnishing of silver appear to have wide applications. The applications of these methods to copper may be of greater importance industrially than that to silver. It also appears very probable to us that the process may be applicable to other metals such as iron.

General view of the analytical laboratory at Michigan Smelting and Refining Division of Bohn Aluminum and Brass Corporation.

Application and Finishing of Antimonial Lead Castings

By Nathaniel Hall, Ch. E.

A description is given of the technique of slush molding of antimonial lead alloys. Commercial methods of preparing the alloy castings for plating and finishing as well as the plating procedures are described. —Ed.

Introduction

Antimonial lead castings serve a field of application intermediate between that of high temperature sand or chilled mold castings such as brass, bronze, iron, etc., and zinc, aluminum or magnesium base die castings. A comparison of the advantages and limitations of these three types of casting methods will illustrate to best advantage the part that lead casting plays in industry.

High melting or hard metal castings are employed where strength and resistance to temperature, corrosion and abrasion are desired. This type of casting requires many finishing operations for the production of a good lustre. Accurate dimensions are not possible and machining is often necessary when the casting is used in an assembly. However, the cost of the mold is very low and heavy castings weighing many tons can be produced.

Die casting opened a new field in the mass production of parts to fairly exact dimension which were interchangeable, and the surface condition of which was such as to require very little polishing. The molds are expensive and the process is therefore usually limited to applications where machining operations are to be kept at a minimum, and light weight together with strength are desired. Due to the labor and expense of operating the casting machine, the process is not suitable for runs of less than a few hundred at one time, although one automobile manufacturer found it more economical to make a die for a *total* production of only two hundred special windshield frames than to make them any other way.

Ornamental novelties such as book ends, trophies, statuettes, souvenirs and similar products are not required to meet any specification as to strength, interchangeability, or resistance. What is required is a cheap casting which can easily be soldered, does not require much polishing to produce a highly polished surface, and, which can be made economically singly or in quantities without the use of an expensive mold. Antimonial lead or slush mold casting is the answer to these requirements.

Slush Molding Technique

Casting is done by hand, the molten alloy being ladled from a gas-fired pot as in Fig. 1. When the mold is filled, the excess metal is poured back into the ladle and returned to the pot. One of the requirements of an experienced caster is the ability to time this operation so that a sound, hollow casting is produced with a minimum thickness of wall. In order to maintain uniformity in weight and thus avoid waste of metal, occasional castings are weighed. In Fig. I., pepper and salt shakers are being cast and the weights checked on an ordinary postal scale which can be seen in the lower left hand corner of the illustration. While pouring, the mold is supported in the horizontal section of pipe by rods which extend from sections of the mold and allow the caster to pivot the mold when draining the excess metal, thus lessening fatigue.

Figure 1

Filling the mold.

After the excess alloy has been poured out, the mold is immersed in a tank of water to chill the casting. The pins which hold the sections of the mold together and which are visible at the edge of the bench, are removed and the mold is opened, using a mallet when necessary on large and complicated shapes. In Figure 2 is shown a trophy casting as removed from the mold. A study of the casting procedure shows that even a single casting can be produced almost as economically as a number of castings so that quantity production is not necessary to keep the cost down and large stocks of the various items need not be maintained.

The molds are made of bronze. When a run is completed the last casting is left in the mold to keep the parts together. The casting alloy is the lead-antimony eutectic containing from 12 to 13% antimony and melting at about 480°F. Antimony is used to strengthen the casting and also causes the alloy to flow freely into all corners of the mold. The

Fig. II. A trophy casting as received from the mold. A study of the casting procedure shows that even a single casting can be produced almost as economically as a number of castings, so that quantity production is not necessary to keep the cost down and large stocks need not be maintained.

casting pots are hooded and the metal fumes are exhausted. In Fig. 3 can be seen a bank of pots hooded and connected to a header which is exhausted by the blower mounted under the ceiling.

The gates are removed from the castings by a metal saw and the fins and sprues are filed off by hand at filing benches after which the parts are sent to the soldering department. Here various parts are attached to the castings, such as threaded rods for fastening to the bases. Castings which would be difficult and expensive to produce in one piece are made in sections which are assembled using a soldering torch supplied with gas and compressed air as illustrated in Fig. 4 where the workman is attaching together the front and back ends of a figure which was cast in two sections. The small pot in the foreground contains soldering flux, the provision of a turntable at the soldering bench should also be noted. This allows the operator to do the complete operation without any intermediate handling of the casting. When the soldering operations are completed, each lot in its individual box or tray is sent to the finishing department.

Surface Preparation of Castings

For polishing lead castings a well lighted polishing room is very desirable, even more so than for polishing other metals because of the variety of models and contours. Note the well lighted corner in Fig. 5 and the shallow boxes used for the different lots. Because of the softness of the metal and the appreciable weight, only one layer of castings is placed in a box where quality work is desired, such as in the production of statuary or trophies.

In most cases, the first finishing operation is the cutting-down with tripoli on a full disc loose buff. On certain classes of work, this is preceded by a brushing on a tampico wheel with emery cake. With molds in good condition and proper preparation at the filing benches, polishing with a set-up wheel is rarely necessary and often the only operation is coloring with silica compound, lime compound or a pink lime containing crocus. Castings to be satin finished are buffed with a greaseless compound.

Plating of Castings

The polished castings are racked or wired, degreased and are then cleaned cathodically at six volts in a solution containing 2 oz./gal. each of soda ash and trisodium phosphate or a proprietary mild cleaner at about 190°F. for approximately ½ minute. After thorough rinsing, the work is immersed in a solution containing 25% by volume of hydrochloric acid for about five seconds and again rinsed. The acid film is neutralized by an immersion in a solution consisting of 4 oz./gal. of sodium cyanide after which the work is plated for the required finish which may be gold, silver, copper, brass, nickel or chromium.

Various procedures are used here depending on the finish and the use to which the article is to be put. Thus at the plant of Maisto's, Inc., Brooklyn, N. Y., to whom we are indebted for some of the photographs, more than 150 different styles of pepper and salt shakers are produced in various finishes. Castings to be finished in silver are flashed in a standard brass solution, nickel plated for 10 minutes and after rinsing, are transferred to a standard silver strike containing 0.4 oz./gal. (troy) of silver and 8 oz./gal. of free cyanide. After a 30 second strike, the articles are silver plated with various thicknesses of silver. Because of the unusually high drag-out losses encountered when

Figure III.

A bank of pots hooded and connnected to a header which is exhausted by a blower mounted under the ceiling.

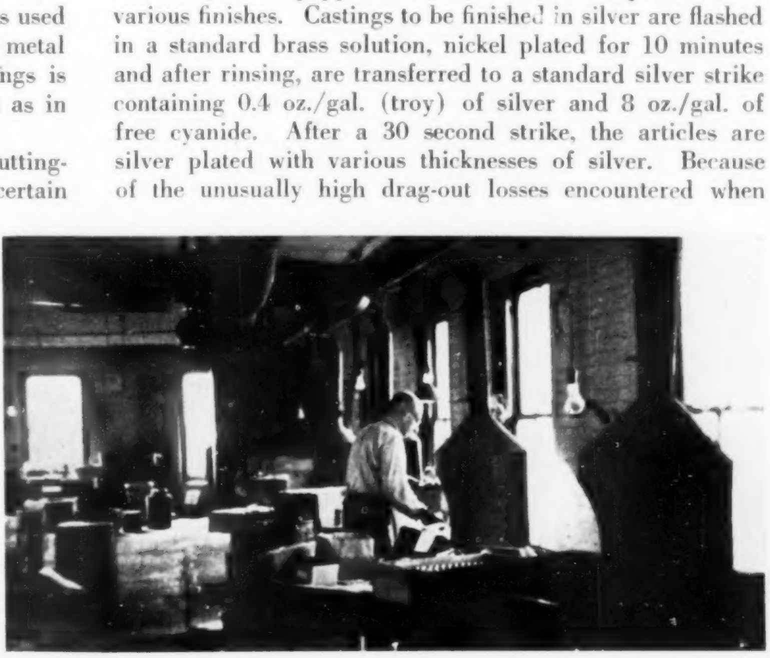


Fig. IV. Soldering bench—note turntable. The workman is attaching together the front and back ends of the figure, which was cast in two sections. Castings, which would be difficult and expensive to produce in one piece, are made in sections which are assembled using a soldering torch supplied with gas and compressed air, as illustrated.

plating these hollow shaker bodies, the metal content of the plating solution is held down to 1.5 tr. oz./gal. of metallic silver with a free cyanide content of 3 oz./gal. of sodium cyanide. Shakers to be chromium plated are nickel plated in a regular cold nickel solution for ½ hour and buffed. They are then re-racked and chromium plated for 1.5 minutes in a 53 oz. solution at 95°F. and 100 amps. per sq. ft. maintaining a chromic acid sulfate ratio of 100:1. In buffing the nickel deposits, care must be taken to avoid heating the castings since the lead softens and the deposits will then blister. Heavy chromium deposits must also be avoided to minimize cracking of the deposits as a result of the high stresses set up.

At the Crescent Art Novelties Co., in Newark, N. J., where metal novelties, lamps, ash trays, trophies and statuary work in antimony lead are manufactured for the better quality trade, articles to be chromium plated are given a copper deposit of at least 0.0003" thickness which is buffed or satin finished. After cleaning, a heavy nickel deposit is applied, the articles are buffed and chromium plated. At this same plant, to whom we are also indebted for photographs used in this article, all work to be finished in silver is given a 10 minute nickel deposit, and, after rinsing, is transferred to the silver strike and plated in a regular silver solution containing 2.5 tr. oz./gal. of metal and 3.5 oz./gal. of free sodium cyanide.

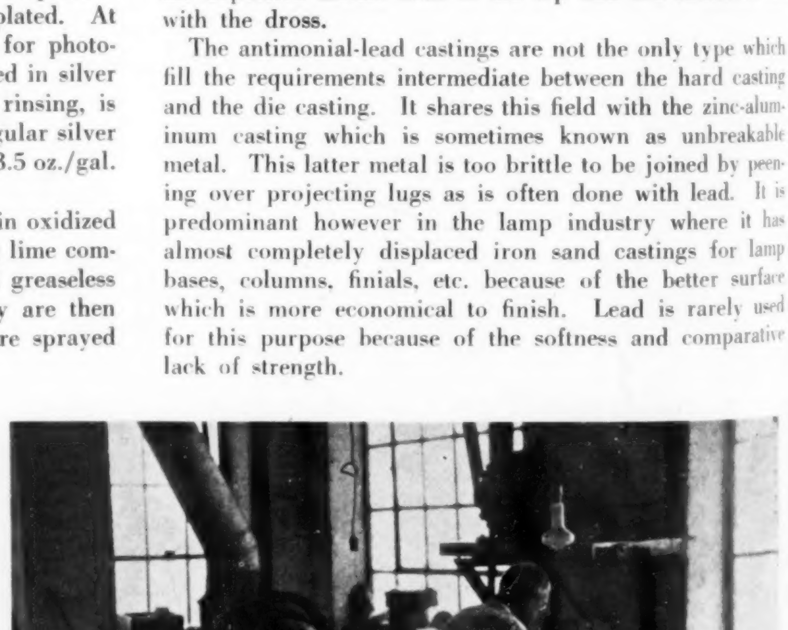
The less expensive line of novelties is finished in oxidized brass or copper and relieved on rag wheels using lime compound or a soft silica for bright highlights and greaseless compound for the satin finish highlights. They are then sent to the lacquering department where they are sprayed with clear, air drying lacquer.

Castings which are used for bases may be sprayed with two coats of non-gloss black or gunmetal lacquer or any enamel color and air dried. The finished figures and bases are assembled in a well lighted section of the building. They are given a final thorough inspection for possible defects and are then packed for shipment. Onyx and solid walnut bases when used, are purchased finished and are drilled in the assembling department for mounting of the figures.

In the manufacture of trophies, the engraving is applied to the base after plating, since if applied first, the engraving would be covered by the deposits which cannot be polished satisfactorily deep down in the cuts and would consequently remain dull instead of bright. Perfect adherence of the deposit is essential to avoid peeling when the engraving tool is applied. When the deposits peel, the engraved trophy bases must be stripped and replated, but other articles which are defective are thrown into the lead pot where the deposited metals float to the top and are skimmed off with the dross.

The antimonial-lead castings are not the only type which fill the requirements intermediate between the hard casting and the die casting. It shares this field with the zinc-aluminum casting which is sometimes known as unbreakable metal. This latter metal is too brittle to be joined by peening over projecting lugs as is often done with lead. It is predominant however in the lamp industry where it has almost completely displaced iron sand castings for lamp bases, columns, finials, etc. because of the better surface which is more economical to finish. Lead is rarely used for this purpose because of the softness and comparative lack of strength.

Fig. V. Polishing lead castings. A well lighted polishing room is desirable because of the variety of models and contours to be polished. Note the shallow boxes used for the different lots as only one layer of castings is placed in a box, due to the softness and weight of the metal.



The Spray Gun in Industry

By Carleton Cleveland

Highland Park, Illinois

The history and technical development of industrial spray guns and equipment for spraying are described. The many uses for spraying equipment are also discussed.—Ed.

History of Spray Gun

The spray gun seen today in the industrial plants as an indispensible unit of equipment in connection with the mass production of an innumerable variety of products—from tiny articles to be carried in a lady's purse to automobiles, motor buses, and railroad cars—had a rather humble origin.

Just what prompted the idea of applying liquid coatings by means of air pressure is rather difficult to determine—perhaps some simple phenomenon, as simple as the one which led to the invention of the steam engine. Anyway, the principle of the spray gun, as used today, is undoubtedly a direct descendant of the old rubber bulb surgical atomizer used in nasal and throat spraying, or even the similar dainty contrivance of milady's boudoir containing, as Milton might say, "An amber scent of odorous perfume," which was sprayed upon her bosom as the last finishing touch of her toilet. Sir Joseph Lister, the noted English surgeon of the last century, in his research into the subject of antisepsis, came to the conclusion that the air carried the chief source of wound infection. He therefore had the operating room sprayed continually with a carbolic acid solution from a sort of makeshift donkey engine. Later Dr. Logan Clendening, in his book "Behind the Doctor" refers to this fact saying, "The air of surgery, indeed from 1867 to 1885, was full of carbolic acid and controversy."

It may have been these early experiments of Lister's that directed some practically-minded person to the thought of applying paint by means of some atomizing device, since Heckel tells us in his little booklet, "The Spray Painting Machine," that "Patents relating to the spray-painting art began to appear on record as early as 1869." Several years elapsed, however, before it was recognized that the principle was capable of wide application in industry, though we do learn that commercial artists fifty years ago found that certain desirable effects could be obtained by using a new device for applying colors by air pressure produced by a hand or foot pump. Other crude early models were used principally for white-washing and for spraying insecticides.

The first big job of spray-painting buildings, with somewhat improved equipment, was that of coating the buildings at the Chicago World's Fair in 1893. It was not until after this, that spray-painting created a sensation, and the spray gun itself began to receive attention as a tool of industry. Mass production in general, and particularly in the automotive industry, gave a mighty impetus to the rapid improvement and scientific engineering of the spray gun as we know it today, with a continued flow of compressed air in place of the cruder methods of air supply. The rapid advance in the use of the spray process in industry was due to its many advantages—speed, cleanliness, economy of time and labor, easy operation, excellence and variety of work performed, and adaptability; and what is also important, it cuts manufacturing costs.

Technical Development

The operation of the industrial spray gun is based on two physical activities within the gun—the coating material must be brought to the discharge outlet of the gun, also a sufficient controlled air pressure must be brought against the liquid stream at the same time to produce the spray. The wide use of the spray process has, of necessity, led to the development of accessory equipment required in connection with the spray process—air compressors; pressure tanks; spray booths to carry off the vapors which accompany the spray process, the booth in many cases being specially designed and engineered to meet certain conditions; and more recently the circulating system where the paint circulates continuously during the painting operation, plants being piped for paint as for water supply.

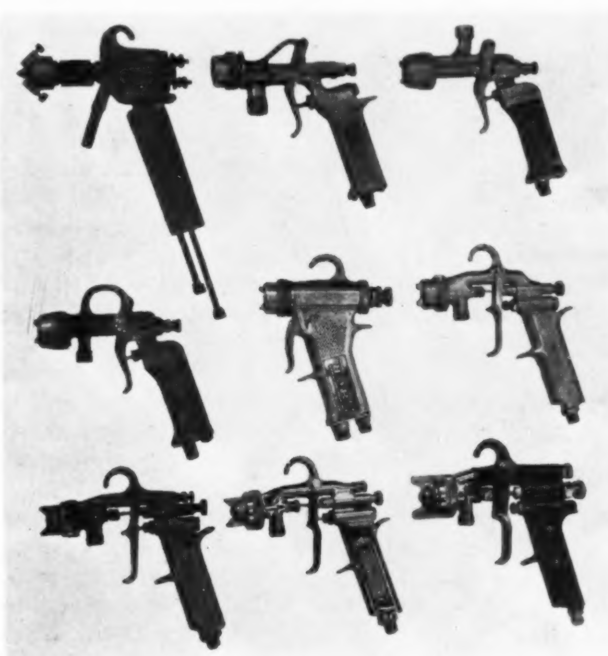


Figure 1

Progressive developments from first model to highly efficient type of today

The earliest types of industrial spray equipment brought air under pressure through the gun and across the open end of an upright tube, the other end of which was submerged in the fluid within a container attached to the lid and spray assembly. The air passing over the end of the tube produced a suction which raised the fluid in the tube. When

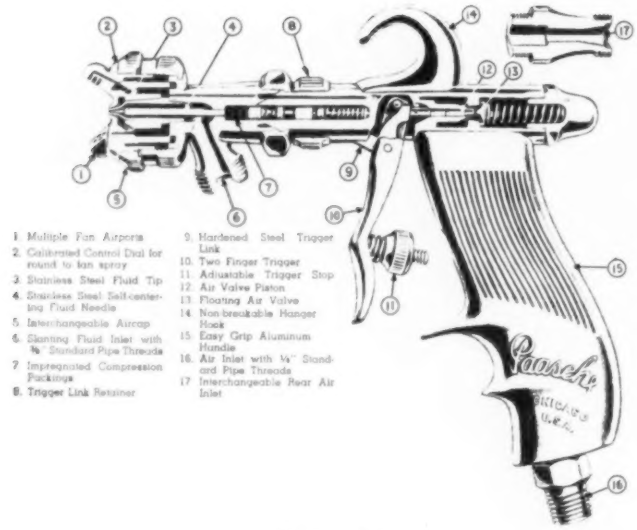


Figure II

Cut-away view of modern spray gun, showing intricate parts.

it reached the top, it was atomized by blasts of air and forced onto the surface to be sprayed.

As spray coating was more widely used, a spray gun was manufactured to be used with a gravity container. The container was suspended from the ceiling and was connected to the gun by a length of hose. This method of feeding, while still used to some extent for certain types of work with satisfactory results, had certain disadvantages where faster work was desired. A development toward more positive, cleaner, safer, and with greater degree of regularity of flow and better control, was the pressure tank, an air-tight container, by means of which air under pressure, supplied by an air compressor, was admitted to the material in the tank through a regulator. This made possible a flow of the spray material to the spray gun nozzle in a manner that was easily adjustable, more positive, uniform, and in greater volume than with the gravity feed. The controlled air, passing through the container, forces the paint or other liquid through a hose to the spray gun nozzle, where it meets the stream of air under pressure and is atomized and delivered to the surface to be coated. Since then, many improvements have been made in the various individual units making up a spray coating installation, but space does not permit the mention of them.

Improvements in the gun itself followed fast one upon the other, so that by now it is a highly efficient tool capable of innumerable applications. High pressure and low pressure guns have been brought out, each in many styles and all having individualities and capabilities of their own. Most spray guns are now made with interchangeable nozzles and spray heads, since continual new developments in finishing materials and protective coatings make it impossible for one type of head to do all the various kinds of work. Interchangeable heads are broadly divided into two classifications,—internal and external—and each of these is again divided into many types and styles. The internal type mixes the air and coating material inside the gun with balanced air and material pressure. These are generally used for low pressure spraying and produce less fog or mist, and are used with slow drying materials such as oil paints, slow drying enamels, etc. They are used in interior painting work where mist is objectionable. The external atomizing heads provide a faster and smoother finish and are used for product finishing, automobiles, furniture, etc. where speed and smooth finish are imperative. They provide finer atomization, and better blending of the pattern is assured with external atomizing heads. The materials used with these are usually fast-drying lacquers, shellacs, sizing, fast drying enamels, varnishes, water solubles, heat materials, etc. Naturally, the material to be applied and the speed desired govern the selection of a specific nozzle or spray head.

While the first spray guns were made with container cup attached, this type, greatly improved since it first made its appearance in industry, is still being used extensively, particularly for light work, small areas, and for touch-up work. Into it have been incorporated practically all of the latest developments that have been made on the separate spray gun, and it is adapted for work where a variety of colors and material are used. The gravity type too is still being used, as mentioned above, but with a gun much improved over its predecessor.

Automatic Spraying

Mass production has given rise to the extensive use of the automatic spray gun. This gun is similar in principle to the separate container type, except that the hand-operated trigger is replaced by an air-operated piston in a cylinder mechanically actuated by a cam or other moving mechanism, which makes the control automatic. This type is for stationary mounting and is used in connection with moving work or automatic or semi-automatic handling devices. As many as 3600 small articles can thus be coated in an hour; or if it is pipe that is to be coated, then 600 ft. can be done per minute.

Spraying Flock

Nor can the gun be overlooked which is designed for the application of dry powders. There are the flocking units, for instance, designed and perfected for the application of flock, powder, granules, etc. in the fields of arts and crafts, and for light industrial work. Numerous novel productive uses are being found from day to day. Manufacturers of

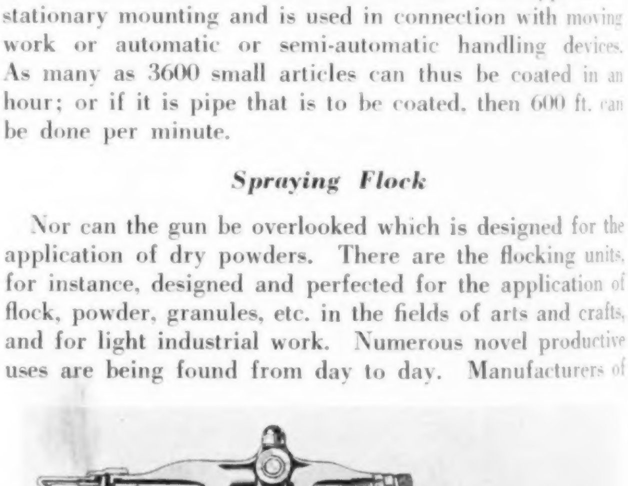


Figure III.

Cut-away view of electrically operated automatic spray gun.

automobiles, airplanes, buses, and trailers frequently flock interiors and pockets. Display materials are flocked to simulate furs, textiles, suede leather; hotels, taverns, offices, and unique little shops are decorated with flocked panels and mural designs. Many new applications are found almost daily.

Small Spray Guns

Besides the spray gun used in connection with industrial work, there is the small air brush used by commercial artists, and to some extent also in industry. Through the years, this small tool has also been developed and the range of its usefulness enlarged, until today, because of its practicability, it is filling an essential place in a varied assortment of activities in the commercial art field—photography, lithography, photo-retouching and coloring, architectural drawings and designs, map-making, jewelry drawings and greeting card work, catalogue and calendar illustrating, china painting, and in advertising and newspaper art work, not to mention its application to certain work in industry. With this unit, not much larger than a fountain pen, a small portable air compressor is used—not much larger than an ordinary typewriter.

The spray guns of the various manufacturers naturally differ as to details, but broadly speaking, the principle of operation is similar. These guns of today are all designed along scientific lines, each manufacturer making a number of types and styles for specific purposes, the object being to place in the hands of the operator a tool that readily and comfortably fits the hand and grip while it delivers a concentrated spray at a steady uniform rate of speed at all times, controlled by a lever in the form of a trigger. The small "pen" type of air brush is controlled by a button which yields to the pressure of a finger.

When one contemplates the almost endless list of applications to which the spray gun lends itself in industrial processes, one wonders how industry ever progressed at all before it had the help of the spray gun. A bold rebuttal might be that industry progressed in the same measure that spraying progressed to meet whatever demands were made by industry for improved methods. The progress of the whole gamut of American industry may safely be said to be a concerted advance in the direction of mass production

Figure IV.

Detachable nozzle extensions for reaching hard-to-get-at places.

Figure V. Loose top spray gun which enables rapid changing of color or material.

and the spray gun had to meet the demands of speed in the application of coatings of a varied and constantly increasing type of surfaces. At the same time it has been necessary to meet the requirements of an everchanging type of coating materials.

Portable Spraying Equipment

In the field of structural painting and decorating, the spray process has added a whole category of interesting and beautiful styles and techniques, and has greatly facilitated and incidentally reduced the cost of many of the older ones. An outfit for this type of work usually consists of a portable air compressor, with gas or electric motor drive; an air receiver with safety valve and pressure gauge; a portable paint tank with air and fluid regulating devices; a spray gun of separate container type, or of special extension type in various lengths for coating ceilings and walls without the use of scaffolding; and air and fluid hose in suitable lengths. Such an outfit may be compactly mounted on a hand-drawn truck that could easily be rolled from place to place, or on skids for operation from a truck or trailer.

Extension equipment is much in use today to reach surfaces inaccessible to the hand or gun. It is much used for maintenance work in manufacturing plants and for exterior painting. One special use has been found for maintenance of transformers in power stations. Before the advent of these extensions, it was practically impossible to paint the backs of the tubes.

Uses for Spraying Equipment

Aside from the application of paints in the building and heavy construction fields, or in the commercial art field, spraying has found innumerable ways of being useful—spraying wax on linoleum; frosting on lamp bulbs; aluminum and other decorative coloring on Christmas trees; moth proofing rugs, tapestries, and carpets; glue-sizing rugs and carpets; applying adhesives; coating paper; finishing leathers of all types; applying latex to the backs of rugs

to slip-proof them; spraying blacking on moulds in foundries, and so on. The spray gun has also found a useful place in the printing industry, where it is seen in connection with press-work to prevent offsetting, smudging, and spotting. The baker sprays grease on his cake and pastry pans as well as icings on his finished products. Spray guns are found in hotels, clubs, hospitals, and other institutions for applying disinfectants. A similar use is also that among florists for the spraying of insecticides and fungicides. In the textile service industry such as laundries and dry-cleaning plants, spray gun atomization has become essential in the finishing of wash suits; in dyeing, tinting, and finishing of gloves and other leather articles, and in finishing curtains and rugs and the resizing of garments. It is also used in preventing the ravages of rust and decay.

Cleaning of Spray Guns

It can easily be seen that only good results can be obtained with such an intricate piece of mechanism when it is kept clean and in good working order. In perfecting the modern spray gun, the manufacturers have so designed it as to make easy cleaning possible. One detailed instruction gives the following: "When used with a cup, syphon a thinner or suitable solvent through the gun, inserting the tube in open container of that liquid. When used with a pressure tank or gravity bucket, after removing material hose turn the gun upside down and pour a thinner into the fluid opening. In both cases, move trigger constantly to

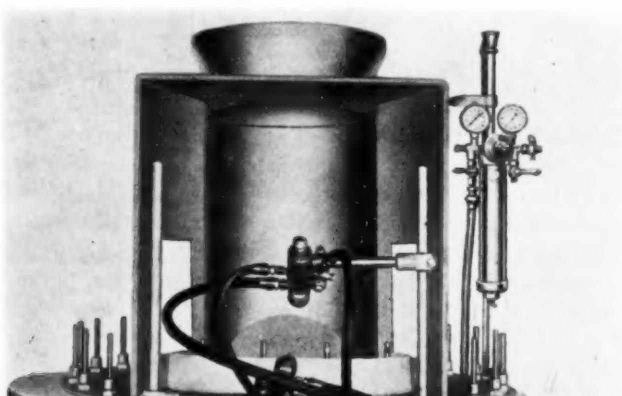


Figure VI.

New type rotary spray finishing machine equipped with spindles, automatic spray gun, automatic control valve, hose, etc., used for automatically coating electric light bulbs, golf balls, jars, radio parts, toys, or any other small articles.

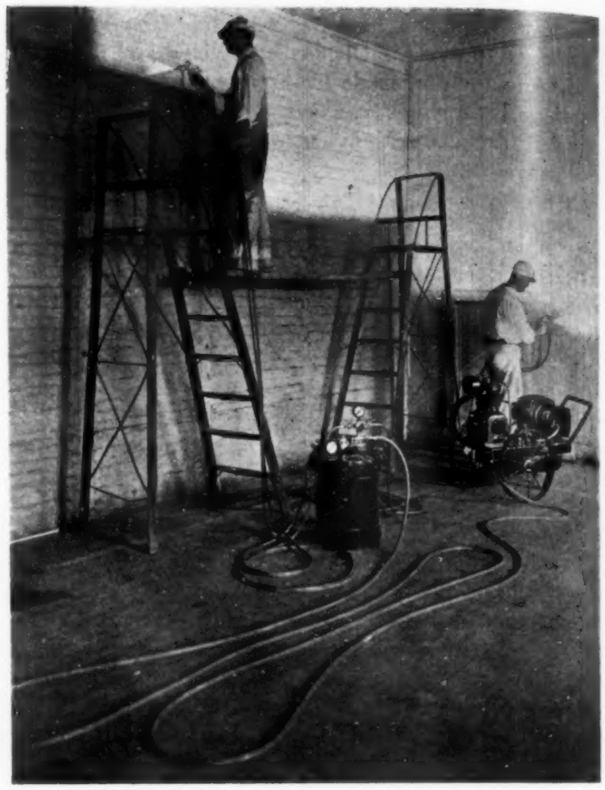


Figure VII.

Spraying painting is practical for interior walls and ceiling of industrial plants, whether of wood, brick, steel, concrete, plaster or structural iron—rough or smooth.

flush out passageway and to clean tip of needle. It is extremely poor practice to place an entire gun in the thinner. It is good practice to place the nozzle and fluid connection in the thinner. Vessel used should be shallow enough to prevent thinner from reaching packing, as it will dissolve oil in leather and packing and result in gun spitting."

Spray finishing by now is so generally accepted as the best means for coating any surface that there seems no longer to be any comparison with older methods. Indeed, industry is today supplied with a complete spray painting and finishing system which includes every item of equipment needed in any modern spray process. There are a number of different units comprising a spray coating installation, each element having its own particular job to do, and at the same time all parts working together as a well co-ordinated system. Every function is performed with speed and precision—from the production of compressed air right through to the ventilation of the finishing area.

Editor's Note:—We appreciate the courtesy of the following manufacturing companies in furnishing data and pictures used in this article:

Automatic Spray Co., New York City, Binks Manufacturing Company, Chicago, Illinois, The DeVilbiss Company, Toledo, Ohio, Eclipse Air Brush Company, Inc., Newark, N. J., Paasche Airbrush Company, Chicago, Illinois, Saylor-Beall Manufacturing Company, Detroit, Michigan, The Wold Air Brush Mfg. Co., Chicago, Illinois.

PLATING AND FINISHING
FABRICATION — ASSEMBLING
METALLURGICAL — ROLLING
CASTING AND JOINING

SHOP PROBLEMS

Technical Advisors For May Issue

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Waterbury, Conn.

G. B. HOGABOOM, JR.
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JOSEPH P. SEXTON
Superintendent of
Plating and Finishing
Sargent & Company,
New Haven, Conn.

When sending solutions for analysis please give following information: name and address; class of work being plated; kind of solution and volume; length, width and depth of tank; temperature of solution; current density, cleaning sequence and any other pertinent facts.

Full information is necessary in order to render proper service.

Dissolving Gold

Q. We are coming to you for help once more. We have a sodium gold cyanide type of plating solution operated at 4.2 volts, in a 4-gal. solution and using 2 14K gold anodes.

To replenish the gold in solution, we employ a porous cup and draw from the anodes. However, we find it very hard to replenish the gold supply in this manner. The other day it took 6 hours to put $\frac{1}{4}$ dwt. of gold into solution. This seems to be much too long for so small an amount of gold. Is there something that we are doing incorrectly, or should we use some other method of replenishment.

A. The use of a porous cup operated under proper conditions will dissolve gold in a cyanide solution readily. The solution should be heated and held between 120° F. to 130° F. and must be stirred continuously at a fairly rapid rate. A voltage of between 2 to 2.5 volts should be used.

Anode rods should be kept clean and gold anodes must have good contact to insure rapid solution.

However, for the small amount of gold solution involved, the use of water soluble sodium gold cyanide would be more feasible.

The salt contains 46% gold by wt. and gold additions can be easily calculated.—T. H. C.

Zinc Plating Malleable Iron

Q. We have been experiencing difficulty with zinc plating on malleable iron padlock cases. The plate forms very slowly, is thin and is also very dark. We have added $\frac{1}{2}$ oz. per gal. of cadmium oxide to the zinc solution.

A. It is difficult to plate iron castings in a cyanide zinc solution. Considerable gassing is obtained, and not much deposition of metal. The explanation has been given that this is due to low over-voltage of hydrogen on the carbon inclusions in the metal with the result that hydrogen is more readily deposited than zinc.

The solution formula you have used is a satisfactory one for a cyanide zinc solution.

Your main source of difficulty is due to excessive acid pickling. This roughens the surface and aggravates the condition by exposing carbon particles according to the above explanation. It would be preferable to clean the castings by sand-blasting, and eliminate all acid dips, or hold them to just a quick immersion.

The use of cadmium in the solution, and of a small cadmium anode along with the zinc anodes, will aid in obtaining a deposit.

Probably your best bet would be to plate these parts in an acid zinc solution. This solution does not have as good a throwing power as the cyanide zinc but your parts are not recessed and will cover all right. An acid zinc will deposit satisfactorily over the pickled castings.—G. B. H., Jr.

Plating on Case Hardened Steel

Q. We have trouble trying to make our nickel stay on steel parts that are case-hardened—1010 steel. First we clean in hot alkaline cleaner at 190° F., rinse in cold water; acid pickle in 10% sulphuric at 160° F., cold water rinse; cyanide dip, cold water rinse, nickel plate. Nickel is at room temperature; pH 5.8 colorimetric, chlorides 2.75 oz., boric acid 3 ozs., metal 4 ozs. From nickel tank, cold water rinse then hot water rinse, dry in sawdust—when parts are bent or friction applied, they will blister or flake.

What can be done to make nickel easier to buff; now it is hard to do so.

A. We assume from your inquiry that no finishing operations are per-

formed on steel parts prior to nickel plating. The heat treatment of the steel parts, such as case hardening with its subsequent quenching in oil, water or any such medium produces a metal surface extremely difficult to prepare for plating. While a clean surface, free from water breaks, may be obtained in the ordinary cleaning cycle, metal deposits will have poor adherence. It is essential that the coating formed by quenching on the surface of the metal be removed before satisfactory nickel deposits can be obtained. Polishing and buffing or wet abrasive barrel rolling will ordinarily produce a surface that will take a nickel deposit that will have good adherence.

After removing surface film, an electrolytic alkaline cleaner should be used. Work should be cleaned both anodically and cathodically to remove oil and grease at a pressure of at least 6 volts. Alkaline cleaners for this type of cleaning can be obtained from any reliable cleaner manufacturer. The alkaline cleaning should be followed by clean hot and cold water rinses. A 10% sulphuric acid pickle can be used at 150° F., but the time in the pickle must be regulated so that there is no appreciable attack or a carbon smudge will form on surface which is hard to remove. A cold water rinse should be used after pickling, followed by a spray rinse to remove all traces of free carbon adhering to surface.

The work should be then given a dip in acidulated nickel salt solution followed by a cold water rinse. (The acidulated nickel dip can be made up with nickel sulphate 3 oz./gal. and a pH 2.0 to 2.3). Nickel plate after final cold water rinse.

The nickel solution mentioned should be heated to around 100° F., for a softer, more ductile deposit. A softer deposit will insure easier buffing.—T. H. C.

Green Color on Cast Bronze

Q. Will you please tell us the procedure in finishing cast bronze objects, to get the green colors, such as are found on imported French castings of horses, figures and other objects of art?

Secondly, are these French castings mentioned, "bronze die castings" or slush mold coatings? If they are bronze castings, how are they made that they are so sharp and clean in detail? There seems to be no evidence of a sand casting. What is this procedure?

A. The following is an old French formula, but I am not sure it will produce the required shade: copper carbonate 2 ozs., ammonium chloride 1 oz., common salt 1 oz., cream of tartar 1 oz., copper acetate 1 oz., vinegar 8 fluid ounces.

There are numerous chemical combinations for a green on copper, bronze and brass which could be tried, such as:

1. Ammonium chloride, copper acetate and water.
2. Ammonium chloride, potassium oxalate and water.
3. Copper nitrate, zinc chloride and water.
4. Copper nitrate, ammonium chloride, calcium chloride and water.
5. Copper nitrate, acetic acid and water.
6. Copper nitrate, acetic acid, ammonium chloride and water, and many others.

I believe most of the French bronzes are on solid brass or bronze as it would be difficult to obtain a green on slush or die castings by corrosion.

A French bronze found on many figures shows many different shades of color from yellow to red and dark browns. The finish has very good adhesion. These colors can be obtained by carefully brushing on a solution of dilute ammonium bisulphide, and after drying, the sulphur separated out is brushed off and a solution of arsenic sulphide in ammonia is applied. The greater the number of these operations, the heavier the color obtained. Antimony sulphide in ammonia gives a reddish brown color. There are also many known formulae for producing colors to match these French bronzes. The green can be obtained by brushing or immersion, but the solution should be diluted for immersion. In stippling, use a soft brush and the finish obtained depends greatly upon the skill of the operator.—J. P. S.

Bright Dip for Cast Aluminum

Q. Please recommend a bright dip for cast aluminum handles which are sand-blasted.

A. For bright dipping cast aluminum alloys, a dip containing both nitric acid and hydrofluoric acid is necessary because of the presence of silicon, copper and iron in addition to aluminum.

A satisfactory dip for this purpose is composed of:

Nitric acid con.	3 gals.
Hydrofluoric acid 48-52%	1 gal.

Use at room temperature.

Ceramic vessels, such as stoneware are not suitable for this dip as they are attacked by hydrofluoric acid. The only metal container which can be used is a lead-lined container with the lead covered with a heavy coating of 1 part beeswax to 4 parts paraffin.

Several organic linings have been announced which are claimed to withstand the combined action of nitric and hydrofluoric acids, and we will gladly furnish you, privately, with the names of the people supplying these materials.—W. R. M.

Heavy Iron Plating

Q. Will you please give me details on an iron plating solution which can be used to deposit heavy coatings.

A. The following bath is recommended for making thick deposits of iron:

Ferrous chloride	40 oz./gal.
Calcium chloride	20 oz./gal.
Free hydrochloric acid, .015 N	(0.074 oz./gal.)

Before operating the bath, it must be completely reduced, and this may be accomplished by suspending scrap iron or plates in it. When completely reduced the solution is a clear green color.

The solution must be kept in a rubber-lined iron tank or a tank lined with acid proof brick. The anodes used are rolled Armco iron. These anodes should be contained in 100% blue African asbestos bags of approximately 2 lb. per sq. yd. weight.

A temperature of 185° F. or higher, and a current density of 60 amps. per sq. ft. are used. The bath is heated by a Duriron steam jet. An ordinary pipe will prove satisfactory, but the latter should be removed after heating the bath.

This chloride bath will produce a smooth ductile deposit which machines readily. A sulphate bath is also used but we have found the deposit from such a bath appreciably harder and more brittle than that produced from the chlorides.

ELECTROPLATING DIGEST

SELECTED ABSTRACTS ON PLATING—F'NISHING—RUST PROOFING—LACQUERING

Anodic Electrodeposition of Rubber on Metals

By Carl Schaefer

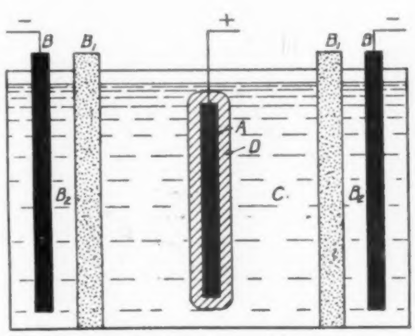
Chemist, Casco Products Corp., Bridgeport, Conn.

The processes of the anodic deposition of rubber are based upon the discovery of Victor Henri in 1907 that the rubber particles in an aqueous latex dispersion, like other colloidal systems in alkaline media, carry a negative electrical charge, and under a electromotive force migrate electrophoretically toward the anode. These tiny microscopic particles are in constant oscillation (Brownian movement) and are prevented from colliding and sticking to each other by the repulsion of their like charges. If, however, the charges on these bodies are neutralized by positive ions in the vicinity of the anode, the particles coagulate and thus form a compact deposit on the anode. Two groups of investigators, one under Sheppard and Eberlin at the Eastman Kodak Company, and another under Klein and Szegvari at the Hungarian Rubber Goods factory at Budapest, Hungary, developed the anode processes for the production of rubber articles and rubber coatings. The principles of the processes are discussed in four basic U. S. patents.* In 1926, the Hungarian and American interests merged to form The American Anode, Inc.

Latex, as it comes from the trees, is unstable and coagulates easily, but when stabilized with ammonia it can be safely shipped and stored for long periods. A latex mix adjusted for anode electrodeposition may, for example, contain 35% by weight of rubber and compounding ingredients, about 20 grams per liter of ammonia, and about 30 grams per liter of ammonium, potassium and sodium salts, the majority of which is ammonium chloride. The usual vulcanizing ingredients such as sulphur, zinc oxide, accelerators, etc. are compounded with the mix in order to effect vulcanization of the deposit. When added in a very finely divided form and suspended in the latex, they migrate to the anode just as do the latex particles and are deposited homogeneously with the rubber at the anode. After drying, these deposits are vulcanized in the usual way to any desired cure.

The electrolytic cell used in the deposition of rubber on metal consists of an anode compartment containing the latex mixture and two cathode compartments containing slightly alkaline water and separated from the anode compartment by porous diaphragms. An anode of zinc or galvanized iron is inserted into the latex and a cathode placed in a cathode compartment. When a direct current passes across the electrodes, a number of phenomena take place. Electrolysis of the dilute ammonia solution produces bubbles of hydrogen at the cathode, increasing the ammonia content and lowering the hydrogen ion concentration in the cathode compartment. At the anode, electrochemical solution of the zinc takes place and also an increase in the hydrogen ion concentration. The positively charged zinc and hydrogen ions passing away from the anode, effect the neutralization and coagulation of the negatively charged rubber particles concentrated near the anode. The resulting coagulum makes up the deposit on the anode.

In addition, the electromotive force causes an electroendosmotic flow of water from the freshly coagulated deposit, reducing the water content to about 40%. This amount



A—Anode with deposit of latex rubber
B—Cathodes
B_1—Cathode diaphragm
B_2—Cathode compartment
C—Latex mix
D—Deposited rubber

Cell used in the deposition of rubber.

is sufficient to maintain the conductivity of the deposit and thus allow the electrodeposition to continue. The amount of this positively charged water which flows through the negatively charged cathode diaphragm endosmotically is approximately equal to the difference between the amount of water associated with the rubber in the bath and the water contained in the deposit. Thus the production of coagulating ions by electrolysis and the adjustments in concentration made by electrophoresis and electroendosmosis make it possible to produce deposits containing 60% total solids from a bath of only 35% total solids without any great variation in the bath composition. Separation of the cathode and anode by a porous diaphragm also serves to maintain a more constant conductivity and pH of the mix—factors which affect the physical characteristics of the deposit.

Considering that rubber is a non-conductor, the thickness of the deposits obtained and the short time required to obtain them are quite remarkable. Examination of the deposits shows them to contain a network of channels through which the electrolyte flows thus allowing the coagulating ions to make their way from the metal surface to the surface of the deposit where they are discharged. As in metal plating, the thickness of the deposit is, within limits, a direct function of the current density and the time of deposition. The weight of the deposit increases also with the concentration of rubber in the bath but decreases as the electrical conductivity of the bath rises. Hence the deposition factor may vary and reaches as high as 4 grams of dry deposit per ampere minute. Only 1.5 grams per ampere minute is over 2400 grams per farad. This is about 73 times the theoretical cathodic deposition rate for zinc. Taking the specific gravity of zinc as seven times that of the rubber deposit, the rate of building up of thickness of deposit is more than 500 times as fast with rubber as it is with zinc.

Current densities of 0.05 to 0.15 amperes per square inch are used to produce deposits of 1/32 to ⅛ inches in thickness. Higher current densities are limited in their use only by the high resistance of the fresh rubber deposits and cause excessive heating at the anode. The voltages required depend upon the current density and may vary from 10 to 100 volts.

The choice of anode material is important. Zinc is preferred because it is easier than most metals to put into solution in an alkaline medium and because its oxide which becomes incorporated in the deposit aids in the subsequent vulcanization. Other suitable metals are lead, cadmium, magnesium, tin and antimony. Copper and its alloys are not very satisfactory because the formation of cuprous salts affects the aging properties of the deposit.

Electrolytic dissociation of the alkaline serum results in the formation at the anode of hydroxyl ions and nascent oxygen which

*Sheppard and Eberlin, 1,476,374 Dec. 4, 1923; Klein, 1,548,689 Aug. 4, 1925; Sheppard and Beal, 1,589,325 June 15, 1926; Klein and Szegvari, 1,825,736 Oct. 6, 1931.

(Concluded on page 234)

Post Scripts

Now that the war "jitters" are subsiding perhaps we can pay more attention to our problems in the U. S. A. and get business under way. Those so-called statesmen howling that we can't keep out of war (which I doubt will come) should study the prudence of Norway, Sweden, Switzerland and Denmark who lived next door to the World War without becoming embroiled. We have 3000 miles of ocean separating us from Europe and that should be a big enough fence to make us stay in our own backyard regardless of how intense our sympathy or hate may be.

• •

C. F. Francis-Carter of England, an author of one of the papers from Europe to be presented at Asbury Park recently wrote that he saw *Prof. Glazunov's* picture in the March *Metal Industry*, but has not heard how he has fared since Pribram, Czechoslovakia has come under the protection of Adolph's minions. Dr. Glazunov's life seems to be harassed by changes in government. He was of the "white" Russian aristocracy and was lucky to escape the executioners of the Red Revolution.

• •

Thanks to *Al Braun* of the Agate Lacquer Co., the writer had a pre-view of the World's Fair. Previous to the visit, I had only a half-hearted desire to visit the Fair as the rigor of tramping the miles of Chicago's Extravaganza has not been forgotten, but we departed from the N. Y. Fair thinking only in superlatives—It's educational, colossal, stupendous, amusing, interesting ad extremum—in other words, you ought to go.

• •

Two automobiles with locked bumpers, standing in front of *Wm. Belke's* Chicago plant were causing the owners much grief in their futile efforts to separate the bumpers. Belke attracted by the commotion came to investigate the *casus commotioni* and upon observing the predicament, merely said, "Call Larry". "What-a-man" Larry, dropped his knitting, walked up to one of the cars, took hold of the bumper and lifted the car sidewise separating the bumpers. J. T., our observer, turned to "Tarzan" and said, "you ought to be a strong man in the circus—why I never"—"Circus nothing", interrupted Larry, "I wanta be a watch maker."

• •

"Tommy" C. S. Tompkins, Wyandotte representative in Chicago, will report on the news of the Chicago district for *Metal Industry*, so if you see him making notes on his shirt cuffs, he's just emulating the late O. O. McIntyre.

The semi-annual Leacrest Stag Party will be held Saturday, May 13, starting at 1:00 P.M., at Leacrest, Bob Leather's farm in Bethlehem, Conn. Hamburgers, hot dogs, etc., will be served. *Bob Mooney*, is tariff collector.

• •

Oscar Weickman, librarian of the Chicago branch of the A.E.S. recently got back on the job after several months of fighting an infection of the hip bone. He seems O. K. now and everyone was glad to see him back.

Wow! What a fish! Ray O'Conner, hero of drama on page 230 just landed the pike from Diamond Lake, Ontario.

Carl Holmgren, formerly superintendent of the Mechanical Plating Co., Chicago, Ill., is starting up in business for himself under the name of the *Apex Plating Co.* He will confine his efforts for the time being to cadmium and tin plating. Good luck, Carl.

• •

Arthur Mintie, foreman plater for the Tubular Rivet and Stud Co., Boston, Mass., is also renowned for his clam chowder, recently serving 500 people. He is well fortified with relatives in the plating industry with *Bill Gray*, his brother-in-law and *Bob Gray* a son-in-law. Arthur's father was with the Waterbury Buckle Co., 27 years, and Arthur also spent 10 years with Waterbury Buckle. Bill Gray is now carrying on the family traditions there.

• •

Notes at the Hartford Regional A.E.S. Meeting

Bill Kennedy, Joe Downes, Jack Costigan and *Ernie Bancroft* all agreed the meeting was a success—so do we all.

•

The beautiful young lady who has been with *Joe Sullivan* (Chief Chemist of New Haven Clock Co.) at many of the A.E.S. meetings is *Miss Geraldine O'Brien, of* Meriden, Conn., the future Mrs. Sullivan. Joe will take the fatal step in the Fall.

•

Frank Clark is the father of twins—he helped to start both the Boston and Hartford A.E.S. branches.

•

Carsten Kohrs of Torrington, with the help of *Mrs. Kohrs,* seemed to enjoy himself and reported that his woes in nickel plating ice skates are at an end.

•

I reported in a previous issue that *Dave X. Clarin* was a master "anecdotalist" but it appears that other Oakite ambassadors are strong contenders for his title; namely, *Ed. Rinker, Leo Miller* and *Cunningham* who patrols the New Haven territory.

•

Fred Fulforth, Joe Underwood and *LeRoy Beaver* were up from Philadelphia. *Arthur Mintie* and *Andy Garrett* from Boston and some thirty-odd delegates from Newark headed by *Horace Smith, John Kotches, Paul Oldam* and *George Wagner. Ralph Liguori, Frank MacStoker, Nelson Sievering* and *Lionel Cinamon* were some of the N. Y. representatives.

•

Austin Wilson gave what I at first thought was the finest example of ad libbing since Gabriel Heatter's hours' work preceding Hauptman's execution. I later learned, however, that it was his regular speech and he was not talking to fill the time while the moving picture projector was being fixed.

•

Clarence "Chick" Helmle, successor to my headaches at the General Electric Co., bore up well under the strain of his first annual meeting. Chick will have to go in training, however, for the annual convention at Asbury Park.

•

Ed Charleson, Asst. Supt. of Finishes at Yale & Towne Co., Stamford, Conn., started *Nathan Promisel, Lionel Cinamon, Clarence*

Helmie and the writer in a deep discussion on the mechanism of conducting salts in plating solutions. *Dr. R. R. Rogers* of Columbia University will give his version on the Shop Problem pages of our June issue.

•

Jim Reynolds, Johnnie O'Conner, Jim Huey and the editor just had to get together to talk about the days gone by when we were all Sargent & Co. employees. *Joe Sexton* was certainly missed as he would have completed the picture. *Ted Eichstaedt* of Detroit, is also a Sargent alumnus.

•

Ralph McCahan, the Sage of Thornwood, DuPont representative, who is shown below, contributed much to the success of *Fred Norgren's* cider festival by his amazing exhibition of Palmistry. The ladies were particularly impressed when he said in all

RALPH McCAHAN

cases that they should handle the purse strings as their husbands were careless with money, (darn you, Ralph, see what you've done). Incidentally, Ralph, the ladies aid of Hartsdale wants you to perform at their strawberry festival in June.

• •

Royal F. Clark, Sr., a charter member of the A.E.S., is widely known throughout the country having spent 38 years in the business. Do you know, however, that he has been an ardent philatelist (stamp collector) and coin collector for 47 years, starting with some coins he gathered at the Columbian Exposition in 1892. A couple of years ago, he inoculated *Walter Barrows* with philatelic fever. *Thomas Slattery* is another stamp fan.

• •

A Long Line of Platers—The Strattons

One of the quietest and most gentlemanly of the old school of electroplaters is *Wilbur G. Stratton*, now retired from electroplating but he still maintains an active interest in the affairs of the Electroplaters' Society, attending all meetings religiously.

Bill can tell interesting stories of the days when cells were used as a source of current and most platers had to make the salts which they used in making the plating solutions.

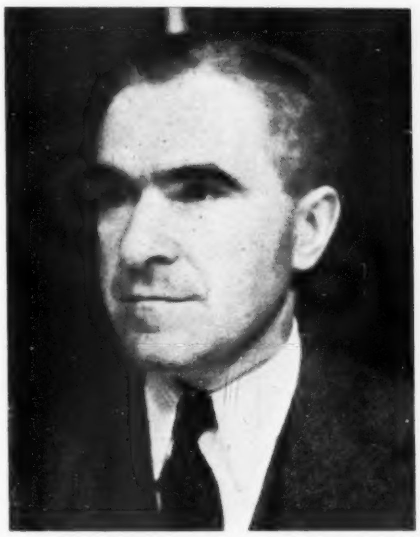
His father, *Henry Stratton*, was engaged in electroplating for thirty years with the Bradley & Hubbard Co., Meriden, Conn., starting in 1860 and retiring in 1890. Bill Stratton started in 1882 under the tutelage of his father and retired last year. His son, *Wilbur H. Stratton* was in the plating business for fifteen years, but has retired due to ill health. Bill's namesake and grandson, Wilbur G. Stratton, is carrying on the plating tradition of the family and has recently become plating foreman of The Bassick Co., in Bridgeport, Conn.

• •

George Muscio Starts His Consulting Laboratory

George C. Muscio, for the past five years chief chemist of the Lea Manufacturing Co., Waterbury, Conn., has recently announced that starting May 1st, he will become a consultant to the electroplating industry.

George was raised in Waterbury, Conn., attending the Crosby High School and entered Yale University in 1913. He worked his way through school doing odd jobs, such as waiting on tables, and in spite of the extra effort entailed in working his way through school, was graduated with general honors. His first job was in the laboratory



GEORGE C. MUSCIO

of the A. P. Munning Co., in Matawan, N. J., and he left this company in 1917 to enter the army. George saw two and a half years of service in the army, and became a second Lieutenant, serving in the Rainbow Division in France. He was in the field artillery and was gassed in action, but he escaped without any permanent physical injury.

From 1919 to 1923, George was employed in mining camps in Arizona and New Mexico, working in the copper and molybdenum mines as an engineer, surveyor and chemist.

From 1923 to 1925, he was chemist for Tiffany & Company, working with *Horace Smith*, foreman plater. For the next four years George was at the Parlin plant of the DuPont Company, plating equipment used in the film division.

In 1929 and 1930, he was with the Hanson-Van Winkle-Munning Company, and for the next two years was employed with the C. G. Hussey Co., Pittsburgh, Pa., where he had charge of the nickel plating of copper sheets which were used at that time for making washing machines.

In 1934, he became associated with the Lea company and was chief chemist for Lea up until May 1st of this year, when he left to engage in private practice for the electroplating industry.

George has a host of friends in the electroplating industry and they all wish him success in his new endeavors.

• •

A Guest Post Scripter

George Hogaboom recently made a trip to the West Coast where he spoke at several meetings and saw how things were done "a way out there". He has kindly contributed the following notes:

•

For asking pertinent questions about electroplating problems, *Hugh Morgan*, San Francisco Branch, leads all others on the Pacific Coast—and, believe me, the questions were right to the point.

•

Sam Herrick, formerly a well known salesman in Boston, Mass., is now the proud owner of "the best job shop" on the Pacific Coast at San Jose, at least he believes he does the best work.

•

Carl Dennis who was well known a few years ago in the buffing composition field in the New York district is dividing his time between manufacturing chemicals, orange growing and the ship beyond the three-mile limit.

•

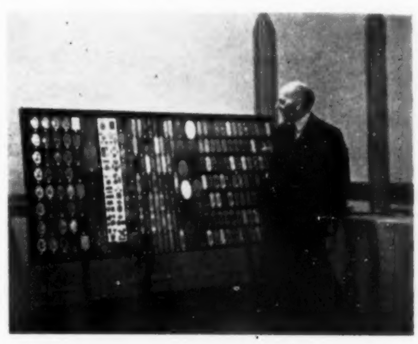
K. Rynkofs, Los Angeles, has one of the strangest ambitions of all platers—the copper plating of the human corpse on a commercial scale.

•

One of the promised exhibits for the Newark Convention from San Francisco is a bouquet of flowers electroplated by *J. B. Esposito*. That will be quite a contrast to the exhibit of *Rynkofs*, which will be a copper plated pig.

•

It takes *Joe Levoy* to cover territory. He attended the A.E.S. meetings at Los Angeles and San Francisco. Is he a booster for the A.E.S.? His whole life has been spent in polishing and plating and he knows his "apples"—no, in California, his "oranges".



G.B.H. snapped unawares by Nate Hall at Newark.

•

Frank Hanlon and his wife were vacationing in southern California. No kidding, did you hear the good news? The New York World's Fair is built upon ground that Frank inherited and almost forgot about. He is to cash in or close up the Fair.

One of the coming men in Los Angeles is *Emmette Hohnan.* He must have had writer's cramp for several weeks after the A.E.S. meetings from taking notes of everything said.

•

Raymond Solivan, Los Angeles, is plater for M.G.M. studios and told us, to our surprise, that all large studios have plating plants.

•

J. G. McCallum, president San Francisco Branch, is also vice-president of the American Society for Metals chapter in that city.

•

The G. E. plant at Ontario, Calif., is one of the neatest plants we have ever visited. A large delegation from that plant attended the Los Angeles annual meeting. *F. A. Maurer* and *C. F. Weber* look after the finishing and plating.

•

Don Bedwell seems to have the inside line on the movie studios. He conducted a party through R.K.O. studios and arranged for the party to have lunch with *Lupe Velez.*

•

Ernest Lamoureux looks as young as when in Chicago on the selling end of plating ten years ago. An ardent worker in the Los Angeles Branch, and when chairman of any committee, he needs no assistance—he does a complete job.

• •

New Uses for Plating

Several new uses for plating technique have been recently given publicity. Cures of 85% of cases of athlete's foot which were uncurable by other means have been reported by the electrodeposition of copper upon the feet from a copper sulfate solution.

The feet are put into a special copper plating bath and it is claimed that deposition of copper results in more intimate contact with the skin thus enabling it to destroy the fungus causing athlete's foot.

Taxidermists are plating the feet of birds to maintain their shape and rigidity.

BITS FROM THE MAILBAG

Retired But Still Wants Metal Industry

New Haven, Conn.

"The sample copy of your magazine has been received and was most interesting.

"I might say also that when I was in London, Ont., I took the METAL INDUSTRY for 25 years; but I have now retired and am living in New Haven, Conn. I am still interested in the work and am enclosing postal note for $2.00 for your special subscription to start with the May issue, and the Platers' Guidebook for 1939."

Yours sincerely,
H. C. Ives.

Analyze Solutions by Taste

The following is an excerpt from one of our correspondents in Scotland:

"The enclosed list contains practically all the plating shops of any importance in Scotland. The others I could mention to you are too small to take any interest in advancement, and are so backward that some of the platers taste the solution to analyze it!"

Has a Complete File of M.I.

"Gentlemen:

This will acknowledge receipt of the May 1938 issue of METAL INDUSTRY which I asked for in one of my recent letters to you.

With this issue, my file of these magazines is complete and I wish to thank you for your kind co-operation in helping me to complete this file.

I also want to express my appreciation for your very interesting magazine and for the 'Platers' Guidebook' which I find very valuable in my work."

Very truly yours,
Anthony Preston, Chemist

Bill Erskine of Rockford, Ill., in an informal moment with the little Erskines.

• •

And Then Bill Broke the Shovel
or
A Tale of the Tavern

Anonymous

Foreword.

In man's struggle from the Dark ages of ignorance to the light of the present day, the integrations of scientific evolution may often have been imperceptible, but after the course of centuries, the results of anthropeic progress are as "moonlight unto sunlight and as water unto wine".

Dramatis Personae:

William Ehrencrona—A Depositor of Metals
Ray O'Conner—Ditto
Gene Phillips—A wayfarer
William Flaherty—A tavern keeper
Numerous and sundry kibitzers, brass rail serfs and men of leisure.

(All of the characters in this story are purely fictitious and if resemblance to actual people exists it is merely fortuitous).

Scene—The Bridgeport Club—Ye modern Cheshire Cheese. The Characters are busily engaged in discussing the arte and crafte of depositing metals.

O'Conner—Did you know that woolen socks make good brighteners for cadmium plating?

Phillips—Yes, I heard they're almost as good as tobacco juice but the control is rather difficult—you have to count the number of socks used.

Flaherty—You plating sissies using all those new fangled notions—first thing I know you'll be using ammeters, voltmeters, electrons and all such tripe.

Ehrencrona—You folks can laugh all you want to, but I found that Rochelle salts are good for copper plating baths.

O'Conner—How much did you use?

Ehrencrona—A scoop full. Then I added a few more scoop fulls and it still worked good.

O'Conner—Scoop full—A scoop full—Plooie, why don't you do things scientifically—How many ounces per gallon or grams per liter did you use?

Phillips—You tell him, Ray—Ehrencrona is just a *rule-of-thumb* plater.

By this time the wrath of Bill Ehrencrona began to arise. The calm of generations of Scandinavian ancestors was not enough to prevent Bill from expostulating.

Ehrencrona—All right, Ray, I use scoops for measuring—What do you use?

O'Conner—Scoops, not for me—I use *shovels!*

It came to pass that Bill Ehrencrona had to suffer indignities to which all true martyrs of science have been subjected.

Scene II. The Plating Room Office of Our Hero. A Week later.

Enter—a clerk.

Clerk—Here is a package which a Mr. Phillips left you—he said the contents were self-explanatory.

Ehrencrona opens package, finding a 6" rule and a rubber thumb from a glove—Starts muttering "a rule—a thumb—a rule" —"So Gene said the contents were self-explanatory—Oh! I get it, So I am a rule of thumb plater, am I?

The stout heart of Ehrencrona was not daunted by this ignominy and it is reported that he applied himself to his books so assiduously that the rule and thumb were soon discarded, and recently he was elected President of the Bridgeport Branch of the A.E.S. Gene has long been forgiven and he joins Bill in preaching to the neophytes of electrodeposition:

Quod Facis Bene Fac
Finis

Walter R. Meyer

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

New Retarder for Lacquer Blushing

A new retarder to prevent "blushing" or "blooming" of nitrocellulose lacquers during drying on damp, humid days has been announced for sale by The Enthone Company, 440 Elm Street, New Haven, Connecticut. It is claimed that this retarder will overcome blushing troubles during days of high humidity for all types of nitrocellulose lacquers applied by spraying, brushing, or dipping. The retarder is said to have wide resin tolerance and high nitrocellulose solvency thus making it compatible with almost all lacquers.

Plant and laboratory trials, it is claimed, have shown that the retarder does not unduly slow up the drying time. Tests of lacquers dried during periods of high humidity have demonstrated that considerably higher film strength and adhesion of the lacquers were obtained when the retarder was used.

A descriptive folder will be sent on request.

A New Protective Coating for Plating Racks

A new synthetic thermoplastic resin in tape form, called Wrap Rax, is marketed by Hanson-Van Winkle-Munning Co., Matawan, N. J. It is reported to resist, chemically, all of the cleaning, pickling and plating solutions commonly used in electroplating, and is therefore, suited for use as a coating for electroplating racks. This coating is said also to withstand the abrasion, mechanical and thermal shocks encountered in ordinary use without cracking or breaking, and its dielectric properties provide perfect insulation. The basic material is made by the Halowax Division of the Bakelite Corp.

The tape is available at this time in one pound rolls of a standard width, ¾". It can be obtained, however, in any width up to several inches. A standard roll contains approximately 250′ of the tape, a sufficient amount to wrap several dozen average sized racks.

Wrap Rax is applied in the same manner as friction tape. It is wound spirally over the parts of the rack to be protected, with a ⅛" to a ¼" lap. The main spine or spines are wrapped first and then the side arms or cross members are covered. At the joint, portions of tape split to ¼" widths are criss-crossed to obtain perfect coverage.

After the tape has been applied, the rack is placed in an oven for 20 minutes at a temperature of 230°-250°F. Being thermoplastic the resin seals into a single homogeneous coating, free from cracks where solutions might enter. After cooling, the rack can be placed into service immediately.

New synthetic resin plating rack tape.

Extensive tests are said to have indicated that this coating is not affected by either strong alkalies, still or electrocleaning solutions or by the strongest acid pickles. The usual electroplating solutions, including chromium, do not attack or weaken the coating, nor do the solutions themselves become contaminated. As the surface of the rack coated with this tape is smooth and glass-like after the sealing operation, it does not absorb or entrap solution, eliminating the danger of contaminating one bath by drag-in from another.

Racks coated with Wrap Rax that have been in service for some time and have been injured mechanically by rough handling can be repaired. Where the coating has been cut or broken through, a patch of this tape is applied, after which it is either sealed in an oven or fanned with a torch to seal the edges. A small bottle of cement is furnished with each roll which can be used for cementing the patches.

Automatic Composition Applicator

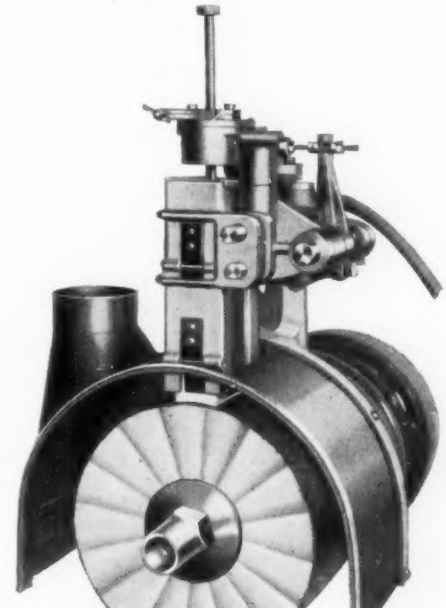
A new automatic composition applicator called the "Auto-Doper," has been developed by the Hammond Machinery Builders, Kalamazoo, Mich., to apply composition automatically to the wheels of buffing lathes, semi-automatics and automatic buffing equipment. The Auto-Doper is operated by compressed air through a three-way valve timed to the conveyor of the buffing machine. On machines without a conveyor unit, particularly semi-automatics and polishing lathes, the timing of the application can be arranged for by an electric timing device or by a foot-operated valve. In the latter case, the operator just steps on the foot treadle when composition is to be applied to the wheel.

The standard Auto-Doper as shown will handle bars from 2" square up to 2" x 6". A similar one is also available that will accommodate 2" diameter bars which rotate after each application, preventing a narrow buffing wheel from cutting a groove in the bar causing waste.

The advantages claimed are: a saving of 25% to 50% on composition (tests show approximately that amount is wasted when applied by hand); a saving of the labor cost and inconvenience of applying by hand; it results in a better finish owing to a more uniform and regular application of composition.

The main castings are of aluminum and the head oscillates so that the bar of composition is applied to the wheel momentarily. As the composition is "on and off" the wheel, the force of air generated by the revolving wheel keeps the composition cool.

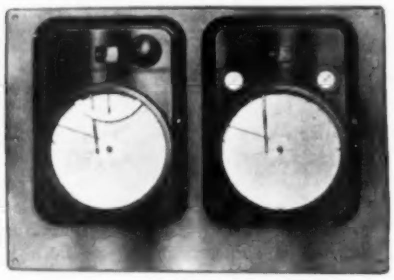
The Auto-Doper can be used, according to the manufacturers, on almost all makes of lathes and automatic equipment being used today.



Automatic composition applicator.

Flow Ratio Control

The rate of flow of one fluid in definite ratio to the flow of a second fluid—automatically controlled—is accomplished by means of a new Flow Ratio Controller, recently developed by The Bristol Company, Waterbury, Conn. One of the features of these controllers is an arrangement which permits changing the ratio at any time by simplying turning a knob on the outside of the case.



Flow ratio controls.

Thus, a 5:1 ratio between the flow of air and fuel gas, a 4:1 ratio between the flow of natural gas and artificial gas, a definite ratio between two different kinds of gasses in a furnace, or a definite ratio between the lean oil and wet gas entering an absorber—these are some of the useful applications for these new instruments.

As shown in the illustration, Bristol's Flow Ratio Controller consists of two instruments—one a standard Flow Recorder and the other a standard Flow Recorder Controller. The rate of flow is measured and recorded by the instrument, which also sets the control point on the second. The latter then records and controls the flow proportionately to the first, depending upon the ratio selected.

Bristol's revised Catalog No. 1051 describes these new instruments.

New Core Binder

As a result of several years of research work by the Borden Company at Mellon Institute, Pittsburgh, Pa., a newly patented process has been developed whereby milk solids are used as a binder for the sand cores of foundry castings.

The product called "Thor core binder" is now being produced commercially by the Casein Co. of America, Division of the Borden Co., 350 Madison Ave., New York City. It is used in both core and facing sands. The binder has the feature, it is reported, of burning freely and quietly. This contributes toward a smoother surface on the casting and produces a core which is quickly and easily shaken out. Thor cores are hard and strong, and yet very collapsible under heat of the casting. Several important manufacturers are said to have made quantity use of this process over a period of years, and it is now considered to be entirely practical and ready for general use.

Sheet Metal Fabricating Machine

A new throatless shear and flanger that will handle a wide range of sheet metal fabrication has been developed by the Quickwork Co., 400 W. Madison St., Chicago, Ill.

The machine is a simplified unit designed as a shear or a flanger, or both. As a shear, it handles all straight and irregular cutting, including full circles and curves, both concave and convex. Material of any width or length can be cut. The smooth, even action of the self-feeding rotary cutters makes it easy to follow the most intricate layouts.

Shear and flanger for sheet metal fabrication.

A simple, quick change of heads converts the machine into a flanger which is equally simple and easy to operate. The shoulders of the flanging rolls act as a guide for the depth of flange. Attachments and rolls can also be furnished for U-ing, wiring, special flanging and forming.

This new machine is furnished arranged for two cutting and flanging speeds. It is ball bearing equipped throughout. Cutter and roll shafts have lifetime ball bearings and all drive mechanism runs in a bath of oil; thus reducing the lubrication job to a minimum.

Complete information on this machine can be secured by writing the Quickwork Company.

Data on Wrinkle Finishes

Data sheets, giving general and technical information on Wrinkle Finishes, are being distributed by Maas & Waldstein Co., 438

New Centrifugal Galvanizer

The Tolhurst Centrifugal Division, American Machine and Metals, Inc., 100—6th Ave., New York City, has designed a new Tolhurst Centrifugal galvanizer, which it is claimed, insures a more even finish for hot-tinned and galvanized articles. Bolts, nuts, threaded pieces, stampings, all kinds of hardware, castings and fittings are handled quickly and the metal coatings obtained are free from hangings and lumps. Threads and fine perforations are produced clean and clear. In fact, in many cases, articles hitherto impossible to hot dip successfully, are said to be beautifully coated in this manner.

The machine consists essentially of the removable basket and retaining cage, which is mounted within the casing. The basket, also used as a container for the work, is carried through the hot metal bath in the usual manner and then placed in the centrifugal galvanizer and rotated. The centrifugal force of the turning basket throws off the excess spelter, leaving an even layer of metal with a high quality finish. The thickness of the coating is controlled by the acceleration of the machine and final speed attained.

Motors are provided with variable speed and acceleration so that all types of materials may be processed with equal ease. The casing is equipped with hinged sides for the easy recovery of slingings, which are returned to the melting kettle.

The new centrifugal galvanizer is built in three sizes, the largest of which is capable of handling articles up to 24" in length. Rated load capacity is 100 lb. and 60 to 75 loads per hour are obtainable.

The new folder describing this machine may be obtained by writing to above company.

Centrifugal galvanizer.

Riverside Ave., Newark, N. J., makers of industrial finishes.

The usefulness of the wrinkle finishes has been extended. The finishes are supplied in all colors, including pure white, light shades and pastels, and being of low viscosity, they have increased covering power and can be applied with a uniformly fine grain, as well as coarse and heavy structures.

The data sheets, supplied on request, cover many details, such as spraying air pressures, baking times and temperatures, method of obtaining various kinds of wrinkles, patching, etc.

Clear Stop-Off Lacquer

The Michigan Chrome Company 6340 East Jefferson Avenue, Detroit, Michigan, has added a new, clear, non-pigmented lacquer to the established line of Miccro Supreme Stop-Off Lacquers. This new coating material was developed to meet the demand of concerns who prefer the non-pigmented type of lacquer for insulating their plating racks.

This lacquer is compatible in every way with the red and black stop-off lacquers which this company has been manufacturing for rack insulation purposes. It can be applied directly to a metal surface with no treatment necessary other than a thorough cleaning of the surface to be coated. It is said to have proved to be practically unaffected through the regular cycle of decorative plating. It has proved very effective in processes such as concentrated or diluted hydrochloric acid or sulphuric acid dips, cyanide or acid copper baths, standard or bright nickel baths and chromic acid baths. It is also claimed to be impervious to nitric and hydrofluoric acids and has proved satisfactory for use with degreasing units.

The Electrodeposition of Rubber

(*Concluded from page 227, Electroplating Digest*)

may oxidize the rubber, and of molecular oxygen which favors the formation of a spongy deposit. Much work has been done to avoid these effects. One means is to use a voltage below the decomposition potential of the electrolyte so that no free gas is liberated. This, however, necessitates low current densities and increases the time of deposition. Another means is the introduction of reducing agents such as sulphides or thiosulphates which have lower decomposition potentials than water and which form solid products at the anode. In these cases the sulphur formed is made available for vulcanization purposes. Similarly, chlorides yield chloride ions which combine with the zinc electrode and no free oxygen is formed. Among other methods investigated is the neutralization and removal of ammonia and the use of preservatives other than ammonia.

The physical properties of the deposits are, if anything, superior to those of ordinary milled rubber. They possess good adhesion and show good resistance to wear, abrasion and corrosive chemicals. The following comparison is typical:

	Electro Sheet	*Commercial Sheet*
Thickness	0.5 mm.	0.5 mm.
Width	4.5 mm.	5.0 mm.
Practical load	5.4 kg.	4.0 kg.
Max. elongation	700%	800%
Practical load per cross section	1600 lbs./sq. in.	1000 lbs./sq. in.

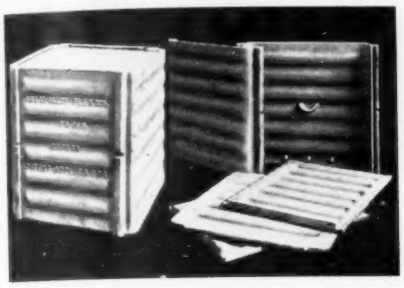
Electrodeposited rubber is particularly adapted for use on articles of intricate shape since good throwing power is another of the process' outstanding attributes. Wire screens, sieves, fan blades for circulation of corrosive gases, racks for use in electroplating, metallic baskets, racks for bottles and protectors for miners' lamps are but a few articles to which this process can be applied. Electrodeposition in conjunction with rubber dipping has also been found advantageous.

Sectionalized Heat Treating Boxes

Sectionalized heat treating boxes are being manufactured by the American Manganese Steel Division, Chicago Heights, Ill.,

based on U. S. Patent No. 2,144,374 issued to Walter G. Hoffman and assigned to the American Brake Shoe & Foundry Co.

These Flexboxes are claimed to have much longer life when used for annealing, carburizing or heat treating than the usual boxes. The boxes are made of Amsco alloy



Sectionalized heat-treating boxes.

and the ends, sides, bottoms and covers are cast separately. The ends are made with vertical grooves into which fit corresponding tongues on the side castings. There are matched slots in both tongue and groove for holding pins to prevent relative vertical movement of the parts, but this does not hinder adequate horizontal movement.

Distortion or cracking, resulting from alternate heating and cooling is said to be avoided in the Flexbox by providing sufficient clearance between tongue and groove to allow for expansion and contraction. Corrugations in the castings give greater strength under high temperatures.

Light cast covers, corrugated or flat, with or without legs, are used to replace the old style bottoms cast integrally with the boxes. Special bottoms in which the edges fit into grooves in the lower edges of the end plates are available where the complete box with its contents is to be lifted.

The claimed features of the Flexbox are: (1) they mechanically avoid the stresses set up by contraction and expansion resulting from rapid heating and cooling, but do not allow any appreciable gas leakage at the vertical joints: (2) thinner and sounder castings result from this design as each section is a simple casting, much smaller than a one-piece box: (3) should a section of the box fail, it is easily and quickly replaced at a fraction of the cost of replacing an entire box.

Low-Bake Enamel

A new enamel for industrial finishing is announced by the du Pont Company. Known as Low-Bake "Dulux" enamel, it is claimed to speed up production in low-temperature ovens. It affords the following baking schedules:

One quarter hour at 250°F: one half hour at 225°F: one hour at 200°F: two hours at 175°F.

The new finish is said to have demonstrated excellent gloss and build, print resistance, and retained flexibility. It is said to be wrinkle-proof under all normal conditions. It gives satisfactory hiding in one coat when applied on solvent-cleaned steel, bonderized steel or primed steel. White and colors are available.

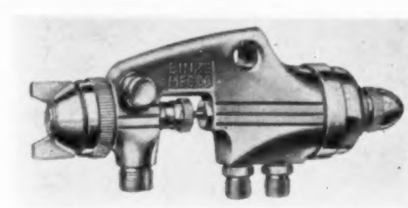
Inquire of Finishes Division, E. I. du Pont de Nemours & Co., Inc., Room 7156 du Pont Building, Wilmington, Del., for further information.

New Streamlined Automatic Spray Gun

The Binks Manufacturing Co., 3114-40 Carroll Ave., Chicago, Ill., now offers a new streamlined automatic spray gun, known as the Thor Model No. 21, which is said to be a radical improvement over the Thor Model No. 10 automatic gun made by this company.

Offered in connection with an improved 3-way valve for cam, hand or foot operation of the air plunger, which automatically operates the trigger of the gun, the Thor No. 21 is claimed to have new perfections in timing and spraying efficiency.

Dripping and spitting are said to have been eliminated, and the positive action of the air plunger gives spraying results equal to hand operated guns.



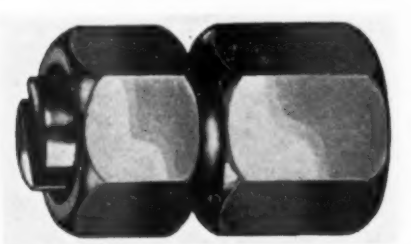
Streamlined automatic spray gun.

The new Thor No. 21 is available in setups for all modern finishing materials, including lacquer, synthetic enamels and ceramic or vitreous materials.

Descriptive catalog sheet will be sent on request.

Spray Systems

The illustration shows a flat atomizing spray nozzle just placed on the market by Spraying Systems Co., 4922 W. Grand Ave., Chicago, Ill. The spray is the flat type with uniform distribution and can be had in a number of different spray angles.



Flat atomizing spray nozzle.

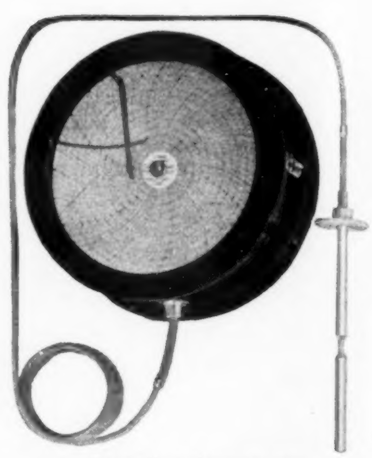
The nozzles are available in ¼" and ⅜" male or female pipe connection. Capacities range from 0.2 to 5.0 G.P.M. at 40 pounds pressure. The strainer is optional in the smaller capacities. Standard stock construction is brass with Monel metal strainer; other metals can be specified.

This spray nozzle is recommended for air conditioning, industrial washing and chemical processes, to be used wherever a flat, wide spray with uniform distribution is required.

Recording Thermometer

The Wheelco Instruments Co., 1929 S. Halsted St., Chicago, Ill., are marketing a precision built recording thermometer with temperature ranges from 0°F. to 1000°F., with charts accurately calibrated over the entire scale range. Some of the features claimed for the new recording thermometer are: faithful reproduction of all temperature variations; design simplicity for minimum maintenance; sturdy construction for long dependable service; pen-arm is chromium plated at tip to prevent corrosion and assure freedom of operation.

The chart may be rotated by either a



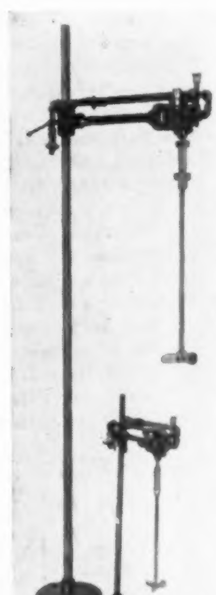
Recording thermometer.

spring-wound clock or synchronous motor.

Literature will be furnished by making inquiry to the Wheelco Company.

Air Motored Mixers

The Eclipse Air Brush Company, Inc., 390 Park Avenue, Newark, N. J., has just introduced a new mounting in its line of Pneumix air motored agitators of the direct drive types. All the features of the Pneumix are retained, including variable speeds (30 to 6000 RPM), quiet operation and elimination of fire and explosion hazards. A laterally swinging cross arm, holding the air motor with direct drive shaft and propeller, is adjustable up and down a vertical bar and can be fixed at any height.



Air-motored mixers and mountings for production and laboratory work.

The ease of lowering the agitating unit (weight 15 lbs.) into the tank and raising it when the operation is completed is the main feature of this new mounting.

The illustration shows two extremes in this series: the little AL for laboratory work and the five-foot BL, a stationary unit for production work. Shafts and propellers in this series are standard in chromium-plated or stainless steel. Other metals are available to meet unusual conditions.

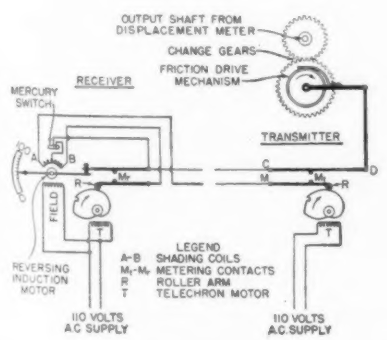
Flow Recorder

A new Flow Recorder operating to indicate and record instantaneous values of rate of flow as measured by displacement meters has been developed by Bailey Meter Company, Cleveland, Ohio.

This device, which employs the Bailey Syncho - Meter electrical transmitting method, differs from the usual flow recording attachment for displacement meters in that it draws a graph of rate of flow against time instead of simply recording total flow over a given time. It is attached to the displacement meter body by employing the flange bolts. The displacement meter register is raised by a filler block to afford room for bevel gears and a short shaft extension is used to drive the register of the displacement meter. The bevel gears drive a shaft which operates the Synchro-Meter unit. No change or modification of parts of the displacement meter is required for the attachment of the Synchro-Meter device.

Flow recorder.

As will be noted in the diagrammatic drawing, the contact arm CD is connected to a friction drive mechanism so that operation of the displacement meter causes it to descend until contact Mt is made. Contact Mt remains closed until the constant speed cams driven by Telechron motors "T" reach their maximum throw. The constant speed cams are shaped so that the roller arm Mr descends more rapidly than the friction driven contact arm CD so that the latter is free to descend a distance proportional to the rate of flow through the displacement meter.



Diagrammatic view of flow recorder operation.

The recording and indicating instruments of the receiver are positioned by a reversing induction motor which runs in one direction when shading coil "A" is short circuited, and in the other direction when coil "B" is short circuited. The circuits through these coils are closed by contact Mt in the transmitter and Mr in the receiver. To maintain contacts in satisfactory operation condition at all times, these circuits are opened by the mercury switch just before the constant speed cams reach maximum throw. The mercury switch closes again before the roller arms start upward. This closes the circuit so that contacts for positioning the receiver may be made while the roller arms are rising.

The diagram illustrates conditions which prevail when the rate of flow through the displacement meter is at 50% of maximum capacity. Under these conditions contacts Mt and Mr are made at the same instant so that both coils of the reversing induction motor are short circuited and no change is made in the reading of the receiver. Should the rate of flow drop to zero, the friction wheel would be stationary and the arm CD would remain at a position corresponding to maximum throw of the constant speed cam. This would cause contact Mr to close before contact Mt with the result that shading coil B alone would be short circuited and the receiver would be positioned to zero.

If the rate of flow were increased above 50% of maximum, the speed of the friction wheel would be increased causing arm CD to descend more rapidly and consequently to reach a lower point so that contact Mt would close first. This would operate the reversing induction motor to increase the reading of the receiver.

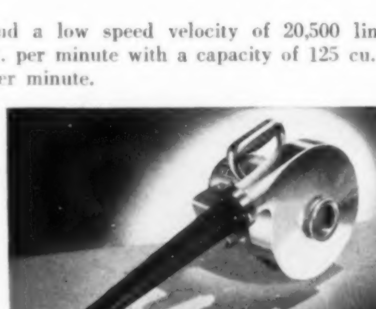
This Synchro-Meter device is particularly useful when it is desired to indicate and record the instantaneous rate of flow of fluid which cannot be satisfactorily measured by orifice type meters, and may also be used as a tachometer for indicating or recording the instantaneous speed of any rotating shaft and is especially desirable for low speed (1 to 5 RPM) measurements.

All-Purpose Blower

The Clements Mfg. Co., 6650 S. Narragansett Ave., Chicago, Ill., have developed an all-purpose blower which can be used as a suction cleaner as well as a sprayer.

The blower has two speeds permitting more general application of the blower. It is recommended for removing dust and dirt from windings and bearings of large electric motors and generators, and very highly inaccessible parts of massive machinery and equipment. The blower can be instantly converted into a sprayer for spraying paints, lacquers, insecticides, etc.

It is claimed that the high speed develops an air velocity of 26,000 lineal ft. per minute with a capacity of 176.5 cu. ft. per minute and a low speed velocity of 20,500 lineal ft. per minute with a capacity of 125 cu. ft. per minute.



All-purpose blower.

Manufacturers' Literature

Air Cleaner. Oil Bath Air Cleaner. Bulletin 130-A contains information on the Cycoil oil bath air cleaner, air filters for engine and compressor protection; also includes a capacity table. American Air Filter Co., Inc., Louisville, Ky.

Air Conditioning. Air Conditioner Series H. is described and illustrated in this catalog. Some of the advantages claimed are: attractive appearance, casing of heavy gauge metal, motor inside casing, liberal space for internal piping connections, large condensate pan under entire unit, internal insulation and sound treatment, etc. American Blower Corp., 6000 Russell St., Detroit, Mich.

Air Filter. Bulletin No. 250, March 1939, is devoted to a new development in which, it is stated, electrical precipitation has been combined with automatic air filtration to obtain the combined advantages of these two methods of cleaning air. American Air Filter Co., Inc., Louisville, Ky.

Aluminum. Aluminum and Its Alloys. Catalog No. 5A. All items listed in this catalog are products of Aluminum Co. of America, except where otherwise indicated. Strahs Aluminum Co., 79 White St., New York City.

Anodes. Graphite Anodes for Transmitting and Rectifying Tubes. Among the features claimed for these anodes are: increase allowable plate power dissipation; lower temperatures of associated tube parts; withstand severe overloads; defy warping; prevent hot spots or fused holes, etc. Speer Carbon Co., St. Marys, Pa.

Barrel Plater. Utility Barrel Plater. A circular describing and illustrating the Lasalco utility barrel plater. Lasalco, Inc., 2822 LaSalle St., St. Louis, Mo.

Bronze. Phosphor Bronze. Revised booklet containing fundamental information to which has been added data on recent refinements and developments in the production of Riverside phosphor bronze. Some standard and unusual applications are illustrated, which it is hoped, will serve to show, in part, how diversified are the problems which phosphor bronze, made to exact specifications and for individual fabrication, has solved. Riverside Metal Co., Riverside, Burlington Co., N. J.

Burnishing Barrel. Ball Burnishers. This catalog discusses ball burnishers No. 1, belt drive; burnisher No. 2, motor drive; burnisher No. 3, motor drive, and Lectric tumbler, of the Lasalco, Inc., 2822 Lasalle St., St. Louis, Mo.

Degreasing. Leaflets with the following titles, *Cut Loose from Metal Cleaning Worries with Detrex Degreasing; Detrex Degreaser for Every Cleaning Job,* and Detrex

Means Quality Metal Cleaning, have been published by the Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich.

Equipment News. Bulletin No. 3-R-38, Bulletin No. 4-M-38 and *Bulletin No. 5-R-38*, giving news of the equipment of Farrel-Birmingham Co., Inc., Ansonia, Conn., including the Banbury mixer, heavy duty roller grinder, and new molding press.

Generator Brushes. Motor and Generator Brushes and Carbon Products. Catalog supplement B-9-37, giving description of brush grades, electro-graphitic series. Speer Carbon Co., St. Marys, Pa.

Heat Exchangers. Duriron Heat Exchangers. Bulletin 1601-A. These heaters, it is claimed, are becoming popular in plating plants, especially for use in the external heating of bright nickel solutions either in connection with or independent of continuous filtering. There are several combinations possible. The Duriron Co., Inc., Dayton, Ohio.

Industrial Furnaces. Catalog No. 105 graphically explains the "Econotherm principle" used in the design of Barkling industrial furnaces by means of which heating-up time and fuel consumption are said to be reduced and constant temperatures are more readily maintained. Additionally, the complete line of Barkling semi-muffle, round pot, tempering, melting, forge, continuous chain-belt conveyor and other types of furnaces as well as quenching and washing equipment is shown. Barkling Fuel Engineering Co., 400 N. Paulina St., Chicago, Ill.

Jar Mills. Roller Type. A circular issued on the one-jar mill, complete with 1½ gal. Loxeal jar, standard motor and a supply of Danish flint pebbles. United States Stoneware Co., 60 E. 42nd St., N. Y. City.

Machine Tools, Instruments and Machinery. A catalog showing the complete line of machine tools, instruments and machinery handled by the George Scherr Co., 128 Lafayette St., New York City. Included also are several items claimed to be shown in the United States for the first time, and outstanding among these is a bore inspection telescope for inspecting interior surfaces of tubes, pipes, forgings, cans, barrels, hollow sections of aeroplanes and other articles.

Nickel. Mechanical Topics. Vol. 3. No. 1. A publication issued by the International Nickel Co., Inc., 67 Wall St., N. Y. City, containing topics, such as, "Putting the Heat on Valve Materials," "How Hard is Red Hot Metal"? etc.

Nickel Silver. Waterbury Nickel Silver. A well illustrated booklet giving the history of nickel silver from raw materials to finished product. Waterbury Rolling Mills, Inc., Waterbury, Conn.

Price List. Quarterly Price List. April 1939. R & H Chemicals Dept., E. I. duPont de Nemours & Co., Inc., Wilmington, Dela.

Precision Measuring Tools. Catalog No. 30 on a new light wave measuring equipment, an improved light wave micrometer, high speed steel measuring wires, a simplified gear wire system, gage blocks and plug gages. It contains reference tables for using gear wires, Whitworth and metric measuring wires, a table of coefficients of expansion and a reprint of the complete specifications on measuring wires as set forth in the report of the National Screw Thread Commission. Van Keuren Co. 12 Copeland St., Watertown, Boston, Mass.

Refractories. A folder describing high heat duty fireclay brick, moderate heat duty fireclay brick, and silica brick, manufactured by the Southern works of the Harbison-Walker Refractories Co., Farmers Bk. Bldg., Pittsburgh, Pa.

Sand Blasting. Blast Generators for Metal Working Industries. Bulletin 36-A describing and illustrating the line of sandblast cleaning equipment made by the Ruemelin Manufacturing Co., 3860 N. Palmer St., Milwaukee, Wisc.

Simplified Arc Welding. A folder giving examples and facts that are said to prove what can be accomplished with the new 40-volt arc welding; illustrated. The Hobart Bros. Co., Hobart Sq., Troy, Ohio.

Solvent Degreasing. This bulletin features solvent degreasing of metal parts, including automatic degreasers for heavy production, and Blacosolv. G. S. Blakeslee & Co., 19th St. & 52nd Ave., Cicero, Sta., Chicago, Ill.

Steel Horizons. Volume 1, No. 1, attractively illustrated and containing the following chapter headings: In the Light of the Past We Look to the Future, by Vere B. Browne; Stainless Steel; The Commercial

Aspects of Stainless Steel, by John H. Van Deventer; Allegheny-Ludlum. Published by Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

Technical Information on Monel, Nickel and Nickel Alloys. Bulletin T-5, revised as of March 1939, giving engineering properties of Monel: Table I contains mechanical property ranges of standard products in accordance with the latest mill experience; Table II has been revised completely so as to agree, with the exception of those for cold-drawn tubing, with the requirements of U. S. Navy Spec. 46M7f dated July 1, 1938, and applicable to mill shipments when specified. International Nickel Co., Inc., 67 Wall St., New York City.

Tumbling Barrel. Triple Action Cutting Barrel. A circular covering the new small sizes, also large sizes, in belt and motor drive operation. Hartford Steel Ball Co., Hartford, Conn.

Welding. Welding Carbon Products. A booklet giving welding carbon products and their use in carbon arc welding. Speer Carbon Co., St. Marys, Pa.

Wire. Fine Wire, Ribbon, Foil. A folder containing a sample of 14K gold strips for galvonometer suspensions, made to definite torsional values expressed in dyne-centimeters per radian twist per centimeter length. Sigmund Cohn, 44 Gold St., New York City.

Metal Washing. Metal Parts Washing Machines. These machines are discussed in a circular by G. S. Blakeslee & Co., 19th St. & 52nd Ave., Cicero Sta., Chicago, Ill.

Quenchers. Spiral Quenchers. A circular on this product, which claims the following features: uniform hardening, no catching of parts, extra heavy construction. G. S. Blakeslee & Co., 19th St. & 52nd Ave., Cicero Sta., Chicago, Ill.

New Books

Protective Coatings for Metals. By R. M. Burns and A. E. Schuh. Published by Reinhold Publishing Corp., New York City. Size 9¼" x 6¼"; 407 pages. Price $6.50.

This book, which represents a complete revision of H. S. Rawdon's book "Protective Metallic Coatings", has been eagerly awaited.

The book on the whole is well written and contains a vast amount of information on metal and organic coatings. As would be expected from the background of the authors, portions of the book dealing with the corrosion resistance of coatings, are particularly comprehensive and well done. However, certain portions of the book are somewhat disappointing and errors were noted in the text on subject matter pertaining to plating. For example, on page 32 is made the statement "soda ash is one of the principal constituents of most alkaline cleaners", which statement is hardly true. On page 33 in a discussion of acid dips for brass and bronze the statement is made "that these are usually mixtures of sulphuric and hydrochloric acids containing small proportions of nitric acid". The usual dips are composed of sulphuric and nitric acid and only small proportions of hydrochloric acid. On page 78 the formula for zinc cyanide is written as $ZnCN_2$ instead of $Zn(CN)_2$.

The sections dealing with plating solutions were, of necessity, written briefly so that the reader could get a general picture of the methods used in preparing the coatings discussed. However, in some cases the simple practices in plating are described in too great detail such as the discussion of barrel plating on page 79, in which the questionable statement "the conveyor (?) with the suspended articles upon it constitutes the cathode".

The text on inorganic coatings is rather scantily illustrated and there are much clearer photographs available giving the details of hot galvanized coatings than the much used rather poor photographs of Finkeldey.

The book discusses: Protective Coatings and Mechanism of Corrosion; Surface Preparation for the Application of Coatings; Types of Metallic Coatings and Methods of Application; Zinc Coating by Hot-Dipping Process; Zinc Coatings by Electroplating and Cementation; Protective Value of Zinc Coatings; Cadmium Coatings and Their Protective Value; Tin Coatings; Nickel and Chromium Coatings; Coatings of Copper, Lead, Aluminum and Miscellaneous Metals; Coatings of Noble and Rare Metals; Methods of Testing Metallic Coatings; Composition of Paints and Mechanism of Film Formation; The Durability and Evaluation of Paints; Paint Practices; Miscellaneous Coatings.

The literature is particularly well covered. In certain cases, notations from the literature or summaries of important statements in the literature are rather ambiguous.

This reviewer well realizes the difficulty in correlating and gathering such a vast amount of information on metal coatings which has been summarized in the text, and the above-mentioned criticisms are only insignificant in relationship to the high quality maintained throughout the text.

This book should be of value to all interested in the selection of coatings for metals as well as the testing and evaluation of these coatings.—W. R. M.

Plating and Finishing Guidebook. Published by Metal Industry Publishing Co., 116 John St., New York. Size 5¼" x 8"; 92 pages. Eighth edition, 1939. Sent free of charge to subscribers of *Metal Industry.*

The eighth edition of this valuable guidebook on plating and finishing has undergone complete revision under the editorship of Dr. Walter R. Meyer.

A staff of well-known consultants has assisted in the preparation of the various chapters in the book. In all cases the subject matter has been brought up-to-date, and in most cases, has been enlarged upon. The subject matter includes almost all phases of plating and finishing, including plating solutions; methods of analysis; coloring of metals; methods of determining thickness of coatings; lacquering; polishing; cleaning; plating tanks, and generators.

The contributing authors to the volume are:

E. A. Anderson
Abner Brenner
T. H. Chamberlain
Dr. George Dubpernell
Dr. A. Kenneth Graham
Nathaniel Hall
George B. Hogaboom, Jr.
Richard O. Hull
Dr. H. G. Mitchell
Floyd Oplinger
Nathan Promisel
Dr. Karl Schumpelt
H. J. Wills

This volume has followed the very high standards of accuracy and practicability which were set by the previous editors of the Guidebook, namely: Oliver J. Sizelove, T. H. Chamberlain and George B. Hogaboom, Jr.

Dictionary of Scientific Terms. By C. M. Beadnell. First American Edition 1939. Published by Chemical Publishing Co., Inc., New York. Size 7" x 5"; 232 pages. Price $3.00.

This comprehensive book covers almost all fields of science, giving many interesting facts and short descriptions of terms used in science.

The book tells in simple language of hormones and vitamins, of wave-lengths, of the size and weight not only of the smaller entities—protons, electrons and atoms—but also of the larger—the earth, the solar system and the Milky Way.

Because of the necessity for abbreviated definitions due to the vast scope of this dictionary, some of the definitions have been abbreviated so that they lack clarity and in some cases are technically incorrect. Such is the case, for example, of the definition of buffer salts which states that "a buffer tends to keep a watery solution neutral", which is not the case as a buffer tends to keep a solution in a fixed pH range, characteristic of the chemicals used. An example of poor definition due to the abbreviated form is that of the definition for emulsion which is, "suspension in water of oil droplets", which definition attempts to define by giving merely an example.

The book should be of value to all those desiring to improve their knowledge of chemical terms.

Important Changes Announced In Methods of Publishing ASTM Standards

Important modifications are to be made, according to an announcement from the Headquarters of the American Society for Testing Materials, in the methods of publishing the Society's standard specifications and tests. These changes are to become effective November, 1939. The major change is to combine the Book of Standards (issued triennially) and the Book of Tentative Standards (issued annually). These changes which also embody numerous advantages are necessary because of the great growth of A.S.T.M. standardization work.

All of the 870 A.S.T.M. standards are in widespread use in many branches of industry and commerce. Each is available, and will continue to be in separate pamphlet form and the standards have been issued in triennially published books of standards with an annual volume giving the so-called tentative standards and tests.

The new method of publication will be to issue the standards and tentative standards collectively in one triennial publication, divided into three parts: Part I, Metals; Part II, Non-Metallic Materials—Constructional; and Part III, Non-Metallic Materials—General. Publication of new and revised tentative standards in the annual *Proceedings*, Part I, will be discontinued; the

Proceedings including both committee reports and papers (about 1300 pages double-column format) will be bound in one volume. The publication of the annual Book of Tentative Standards will be discontinued entirely. (The November, 1938, edition is thus the last one to be issued.)

In the two years between triennial publication of the new Book, Supplements to each of the three parts will be issued, containing revisions and new or revised standards and tentative standards for that year. Since these books will be appreciably larger than the present supplements and will have permanent reference value, they will be bound in cloth. The volume on Methods of Chemical Analysis of Metals published in 1936 will be continued as a separate publication.

This new plan provides that the three parts of the 1939 Book of A.S.T.M. Standards and Tentative Standards will be made up as follows:

Part I, Metals.—Ferrous and non-ferrous metals (all A and B and some E serial designations) except methods of chemical analysis. General testing methods (E serial designations).

Part II, Non-Metallic Materials—Constructional.—Cementitious materials, concrete and aggregates, masonry building units, ceramics, pipe and tile, thermal insulating materials (all C serial designations). Timber and timber preservatives, paints, varnishes and lacquers, road materials, waterproofing and roofing materials, soils (certain D serial designations). General testing methods, thermometers (E serial designations).

Part III, Non-Metallic Materials—General.—Fuels, petroleum products, electrical insulating materials, rubber, textiles, soaps and detergents, paper, plastics, water (remainder of D serial designations). General testing methods, thermometers (E serial designations).

Further details of the publication plan can be obtained from the Headquarters of the Society, Philadelphia, Pa., including sales prices which have been established for the new Book of Standards, 1940-41 Supplements, and the annual *Proceedings.*

Associations and Societies

American Electroplaters' Society

The Educational Program of the annual meeting was printed in the April issue of METAL INDUSTRY, and the complete program will be published in the June issue.

Bridgeport Branch

On April 21, the Branch was addressed at an opening meeting by *Ed. H. Bucy,* technical director of the Zapon Division of Atlas Powder Co., Stamford, Conn. The subject of his talk was "Formulation and Pigmentation of the Latest Types of Organic Finishes."

At the April business meeting, the election of officers was held with the following officers being elected for the year 1939-1940.

President, *Wm. Ehrencrona,* foreman plater, Casco Products Co., Bridgeport.

Vice President, *Ed. Charleson,* assistant superintendent of finishing, Yale & Towne Mfg. Co., Stamford, Conn.

Secretary-treasurer, *Eugene Phillips,* Puritan Mfg. Co., Waterbury, Conn.

Librarian, *Clarence C. Helmle,* Electrochemist, General Electric Co., Bridgeport, Conn.

Chicago Branch

The regular meeting of the Chicago Branch was held at the Atlantic Hotel on April 15, with 115 in attendance.

The annual election of officers took place with the following elections:

President, *James Hanlon,* Chicago City Plating Co., re-elected.

Vice President, *Ed. Lanz,* Northwestern Plating Co.

Secretary-Treasurer, *Marion Longfield,* Pheoll Mfg. Co.

Librarian, *Oscar Weickman,* Great Lakes Plating Co.

Board of Managers:

Clyde Kelly, General Spring Bumper Corp.

Jack Bryden, Chicago Thrift Co.

W. J. Erskine, National Lock Co., Rockford, Ill.

Delegates to the 1939 Convention:

James Hanlon, Chicago City Plating Co.

Frank Hanlon, Chicago City Plating Co.

H. A. Gilbertson, Gilbertson & Son.

Alternates:

Oscar E. Servis, Felt & Tarrant.

Marion Longfield, Pheoll Mfg. Co.

W. J. Erskine, National Lock Co., Rockford, Ill.

Frank Hanlon, who had just returned from a trip to the West Coast, gave an interesting talk about the plating industry on the Coast.

C. S. Tompkins of the J. B. Ford Co., Wyandotte, Mich., was appointed reporter for the METAL INDUSTRY.

Detroit Branch

The Branch will be addressed at the May 5th meeting by *Wm. M. Phillips,* General Motors Corp., Detroit, Mich.

On June 2nd, *J. A. Stifter,* president,

The Milburn Co., Detroit, Mich., will speak on "Industrial Dermatitis in Electroplating."

The Branch has taken 101 new members in during the past fiscal year, making the total membership on April 30th of 234 members, making the Detroit Branch the largest in the Society.

Newark Branch

Two speakers will address the Branch during May. On May 5 *Louis Donroe*, Pyrene Mfg. Co., Newark, N. J., will be the speaker, and on May 19 *George Reuter*, American Can Co., Newark, N. J.

The members of the Branch have been very active during the past few months making final plans for the annual educational session to be held at Asbury Park, N. J., and announce that everything is progressing smoothly.

New Haven Branch

Oliver J. Sizelove of the Frederick Gumm Chemical Co., Kearney, N. J., spoke at the May 2nd meeting on "Cleaning of Metals Preparatory to Metal Finishing."

Thomas H. Chamberlain, supervisor of metal finishing at the Chase Brass & Copper Co., Waterbury, Conn., was technical chairman.

Waterbury Branch

On May 12, the Branch will be addressed by *Dr. Walter R. Meyer*, Managing Editor of METAL INDUSTRY, who will speak on "Metal Impurities in Electroplating Solutions."

Branch secretaries note: Notices of past or future meetings of the Branches of the Society must be received by the 21st of each month, to be included in the next month's issue of METAL INDUSTRY.

The Electrochemical Society New York Section

Raymond R. Rogers, Secretary-Treasurer, Columbia University, New York

A meeting of the New York Section will be held in Room 309, Havemeyer Hall, Columbia University (117th St. & Broadway) on Friday, May 19 at 8:00 P.M. Non-members are cordially invited.

George B. Hogaboom will deliver an address, accompanied by exhibits, on "Coloring of Metals." Metal coloring is steadily increasing in importance and Mr. Hogaboom, with a background of fifty years in the metal finishing industry, is unusually well equipped to discuss the subject. The speaker is, at present, research engineer with Hanson-Van Winkle-Munning Co. He is a joint author of a book on electroplating and was first President of the American Electroplaters' Society and first Chairman of the Electrodeposition Division of The Electrochemical Society.

Electrochemists Elect New Officers

At the annual meeting of the Electrochemical Society held at Columbus, Ohio, the following new officers of the Electrochemical Society were elected:

President: H. Jermain Creighton, Swarthmore College, Swarthmore, Pa.

Vice-Presidents: D. A. Pritchard, Montreal, Canada; Alexander Lowy, Pittsburgh, Pa.; J. D. Edwards, New Kensington, Pa.

Managers: C. E. Williams, Columbus, Ohio; K. G. Soderberg, Detroit, Michigan; J. A. Lee, New York City.

Treasurer: Robert M. Burns, 463 West Street, New York City.

Secretary: Colin G. Fink, Columbia University, New York City.

American Foundrymen's Association

The 43rd annual convention of the American Foundrymen's Association will open at 10 A.M. Monday, May 15, at the Hotel Gibson, Cincinnati, Ohio. Presiding at the opening session will be president *Marshall Post*, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa. Following this opening session the four days of the convention will be devoted to many technical and management and shop practice sessions, extensive plant visitation and social gatherings.

Plant Visitations. In addition to the many industrial plants which will open for inspection by small parties during the week, two special general group works visits will be organized. On Monday afternoon, May 15, the foundry and manufacturing departments of the Cincinnati Milling Machine Co., will be visited, while on Thursday afternoon, May 18, the con-

vention will close with a visit to the Hamilton Coke and Iron Division of the American Rolling Mill Co., which will be followed by a buffet supper at the Hamilton Country Club. The ladies in the party will be entertained at the Hamilton Country Club that afternoon.

Annual Dinner. The annual dinner of the Association is to be held the evening of May 17. A feature of the dinner will be the presentation of three major awards of the Association. To *Harold S. Falk*, vice president, Falk Corp., Milwaukee, the John A. Penton Gold Medal is to be presented in recognition of his leadership in promoting foundry apprentice training. *Donald J. Campbell* is to be presented with the W. M. McFadden Gold Medal as president of the Campbell, Wyant & Cannon Fdy. Co., Muskegon, Mich., in recognition of the achievements of this company in developing casting manufacturing processes. *James R. Allan*, assistant manager of the industrial engineering and construction department, International Harvester Co., Chicago, is to receive the J. H. Whiting Gold Medal in recognition of his engineering contributions to the Association and the foundry industry.

Technical Program. The technical program covers a wide range of papers and committee reports which will be presented in some 30 sessions.

Lecture Course. An innovation this year is a three-session instructional lecture course on "The Microscope in Elementary Cast Iron Metallurgy." This course is to be given by *Roy M. Allen*, metallurgical consultant, Bloomfield, N. J. Mr. Allen has revised and amplified into book form material which he presented before the 1931 A.F.A. convention. Mr. Allen's original material proved of such outstanding value that he was sought as the author of the first lecture course of the Association.

Some of the papers which will be presented are: *Non-Ferrous*, Monday, May 15, 10:30 A.M. Chairman, *Wm. M. Ball, Jr.*, Edna Brass Mfg. Co., Cincinnati, Ohio; Co-chairman, *C. O. Thieme*, H. Kramer & Co., Chicago, Ill.

"Production of Bronze Pressure Castings," by *D. Frank O'Connor*, Walworth Co., Boston, Mass.

"Crucible Melting" by *G. K. Eggleston*, Detroit Lubricator Co., Detroit, Mich.

2:00 P.M. Special works visit to Cincinnati Milling Machine Co.

8:00 P.M. Chairman, *Harold J. Roast*, Canadian Bronze Co., Montreal, Can., co-chairman, *Wm. J. Laird*, Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa.

"Effects of Aluminum and Antimony on the Physical Properties of Red Cast Brass (85-5-5-5)," by *H. B. Gardner* and *C. M. Saeger, Jr.*, Bureau of Standards, Washington, D. C.

"High Conductivity Copper Castings," by *A. B. Kinzel*, Union Carbide & Carbon Research Lab., N. Y. City.

Non-Ferrous Division annual business meeting.

8:00 P.M. Lecture Course—Session 1. Chairman, *H. Bornstein*, Deere & Co., Moline, Ill.

"The Microscope in Elementary Cast Iron Metallurgy," by R. M. Allen, Bloomfield, N. J.

Tuesday, May 16. 10:00 A.M. Non-Ferrous. Chairman, *H. M. St. John*, Crane Co., Chicago, Ill., co-chairman, *W. Romanoff*, H. Kramer & Co., Chicago, Ill.

"The Foundry and Metallurgical Science," by *M. G. Corson*, N. Y. City.

"Influence of Pouring Ladles on Quality of Red Brass," by *R. W. Parsons*, Ohio Brass Co., Mansfield, Ohio.

12:30 P.M. Non-Ferrous round table meeting-luncheon.

2:00 P.M. "Castability of Metals." Chairman, *W. H. Spencer*, Sealed Power Corp., Muskegon, Mich., co-chairman, *Geo. P. Halliwell*, H. Kramer & Co., Chicago.

"Castability of Cast Steel," by *C. H. Lorig* and *E. C. Kron*, Battelle Memorial Institute, Columbus, Ohio.

"Effects of Superheating on the Castability and Physical Properties of Gray Iron," by *N. A. Ziegler* and *H. W. Northrup*, Crane Co., Chicago.

"The Measurement of the Fluidity of Aluminum Alloys," by *L. W. Eastwood*, Aluminum Co. of America, Cleveland.

"Malleable Iron Castability Tests," by *F. J. Ash*, University of Michigan, Ann Arbor, Mich.

4:00 P.M. Lecture Course—Session 2. Chairman, *G. P. Phillips*, International Harvester Co., Chicago.

"The Microscope in Elementary Cast Iron Metallurgy," *R. M. Allen*, Bloomfield, N. J.

6:00 P.M. Engineering Instructors' Dinner. Presiding, *F. G. Sefing*, International Nickel Co., N. Y. City.

American Conference on Occupational Diseases and Industrial Hygiene — Meeting with American Association of Industrial Physicians and Surgeons

This meeting will be held June 5, 6, 7 and 8, at the Statler Hotel, Cleveland, Ohio, and many of the following papers should be of interest to persons connected with the electroplating and finishing industry.

Monday, June 5. Non-technical program —"Conservation of Health in Industry." *Dr. Clarence D. Selby*, president of the American Association of Industrial Physicians and Surgeons, presiding.

Morning session—"Health of Workers." *Dr. R. R. Sayers*, Chief, Division of Industrial Hygiene, U. S. Public Health Service, Washington, D. C.

Afternoon Session—"The Public Health Aspects of Occupational Diseases and Industrial Hygiene." *Henry F. Vaughan, Dr. P. H.*, Commissioner, Detroit Department of Health.

"The Employer's Appraisal of Occupational Hygiene." *G. W. Cannon*, vice-president, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich.

"Fatigue in Industry." *Dr. D. B. Dill*, Harvard Fatigue Laboratory. Lantern slide and motion picture demonstration.

Evening Dinner Session. "The Public Significance of Industrial Health Programs." *Whiting Williams*, Cleveland, Ohio, analyst of public opinion.

Tuesday, June 6. Technical sessions, morning and afternoon. *Wm. P. Yant*, Director of Research & Development, Mine Safety Appliances Co., Pittsburgh, presiding.

"Possibilities of Control of Lead Exposure by Examining Less than 24-hour Lead in Urine Samples." *E. C. Barnes*, Industrial Engineer, Medical Dept., Westinghouse Elec. & Mfg. Co.

"Evaluation of Benzol Exposure." *H. B. Elkins*, Chief Chemist, Bureau of Occupational Hygiene, Mass. Dept. of Labor & Industry.

"Toxicity Studies on Some Cadmium Compounds." *H. T. Walworth*, Bureau of Industrial Hygiene, Detroit, Dept. of Health.

Obituaries

Elborn T. Ward

Elborn T. Ward, Wisconsin manager of the Dearborn Chemical Co., Chicago, Ill., died on April 3, aged 70 years. Mr. Ward was born in Troy, Pa., and was assigned to his post in Milwaukee in 1900.

Joseph W. Crist

Joseph W. Crist, 54 years old, of the engineering staff of the Chrysler Corp., died in Henry Ford Hospital, April 5. Mr. Crist was born in Rochester, N. Y., but lived in Ypsilanti from the age of three. There, he and his brother, George W. Crist, pioneered in the automobile field and built one of the early cars. In 1906 he went to Detroit and over a period of years worked for Ford, Studebaker and Dodge. He was with the Dodge division of the Chrysler Corp. until six years ago as chief inspector. He then transferred to the Diesel division of Chrysler where he worked as an engineer. His brother, George W., is assistant chief engineer of Cleveland Graphite Bronze Bushing Co.

Robert M. Rubush, Sr.

Robert M. Rubush, Sr., 47, metallurgist of the Machined Steel Casting Co., Alliance, Ohio, since its founding, died recently in a Cleveland hospital following a brief illness. His widow, a daughter and two sons survive.

Walter Geil

Walter Geil, president of the Reliable Plating Works, Milwaukee, Wisc., passed away on April 5, aged 56 years. Mr. Geil was born in Milwaukee, and after a connection with the Allis-Chalmers Mfg. Co., for 25 years, became president of the plating firm in 1932. Mr. Geil was a member of the American Electroplaters' Society.

Personals

Burton Daw Becomes President of Lasalco, Inc.

Burton G. Daw, former vice-president of the Lasalco, Inc., 2822 LaSalle St., St. Louis, Mo., has recently become president of Lasalco, Inc., succeeding the late Frank Terrio in his position.

Mr. Daw's early training was received in his father's shop, in a technical high school and at the Michigan State University. After spending several years managing orchards and ranches, he left the farm and went to Chicago in 1916 where he spent a year in the storage battery business. On December 16, 1917, he went to work for the Hanson-Van Winkle Co., in Chicago, under the guidance of *Harry E. Starrett* and *Fred J. Liscomb*. He traveled extensively out of that office until the fall of 1922 when he was made Cleveland branch manager for the Hanson-Van Winkle Co. This position he held until he resigned two and one-half years later.

Burton G. Daw

He was assistant factory manager for a bicycle manufacturer for a year and then went with the Lasalco company on June 6, 1927. After traveling out of Elyria, Ohio, he was brought to the factory in St. Louis and made sales manager in January 1930. In 1936 he became vice-president.

Since Mr. Daw has been with Lasalco, Inc., the company has branched out widely into the equipment field for the plating industry.

Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y., has announced the appointment of *C. M. Hughes* as head of their lacquer department. Mr. Hughes was formerly with the Zapon Div., of Atlas Powder Co., Stamford, Conn.

Dale M. Harpold has been elected vice-president of Vulcan Stamping & Mfg. Co., Bellwood, Ill.

Floyd M. Erlenmeyer, who for the past two years has served as western N. Y. representative of Maas & Waldstein Co., Newark, N. J., has been transferred to the southern N. Y. territory by his company. Mr. Erlenmeyer is well equipped to serve users of industrial finishes in his new district, and he has had wide experience in both the manufacture and application of industrial finishes. He will make his headquarters in N. Y. City.

A. J. Aulerich, identified with the Progressive Welder Co., Detroit, Mich., in the development of the first Hydromatic welder ever built, and for the last four years in the company's Detroit sales and service division, has been transferred to Dayton, Ohio, from which place he will handle sales for the company in both Ohio and Indiana. His headquarters will be 503 Callahan Bldg., Dayton, Ohio.

H. C. Williams has been appointed as general plant superintendent of H. K. Porter Co., Pittsburgh, Pa. He was formerly associated with the Patterson Foundry & Machine Co., East Liverpool, Ohio, and the H. H. Robertson and Blaw Knox Companies of Pittsburgh.

William A. Scheuch, works manager of Nassau Smelting & Refining Co., Inc., subsidiary of Western Electric Co., was elected a vice-president of the Nassau company at the annual meeting of the board of directors, held recently.

Mr. Scheuch, a graduate of Columbia University, joined the Bell System in 1916 as a metallurgist in Bell Laboratories, then Western Electric's engineering department. After serving overseas during the war, he was discharged with the rank of Captain in the Signal Corps and returned to this country to resume his duties with the Laboratories. In 1923, he was transferred to the Hawthorne Works of Western Electric in Chicago, where he served successively in positions dealing with metal research, secondary metals, by-product reclamation, and finally as engineer of the manufacturing branch.

He came to New York in 1931 as works manager of the Nassau Smelting & Refining plant at Tottenville, S. I., and has served in that capacity since then.

Fred L. Curtis of the sales organization of the Norton Co., Worcester, Mass., has been transferred to Detroit, Mich. He succeeds *Paul Brown*, who is to be resident manager of Australian Abrasives Pty., Ltd., Sydney, Australia. *S. J. Bell*, office manager at Detroit, takes over Mr. Curtis' former Jackson territory, while *Milton J. Cowan* from the home office in Worcester, becomes office manager at Detroit.

Thomas M. Bohen, former vice-president, Whitehead Metal Products Co., 303 W. 10th St., N. Y. City, has been elected president, succeeding the late *J. J. Whitehead*. Mr. Bohen started with the U. T. Hungerford Brass & Copper Co., in 1910, as assistant manager of the copper department. In 1912 he was sent to Boston as assistant to J. J. Whitehead, who was then opening the new Boston office for the Hungerford company. He stayed with this firm until 1914, at which time Mr. Whitehead started the Whitehead Metal Products Co., with Mr.

Bohen as his assistant. He was manager of the Whitehead company's Boston office until 1927, at which time he became secretary of the company and transferred his headquarters to New York City. He became vice-president in 1931, and was elected president in 1938. *Herbert G. Fales*, International Nickel Co., vice-president, succeeds Mr. Bohen as vice-president.

Arthur E. Bearse, chemist, and *Howard Peters*, metallurgist, are recent additions to the technical staff of Battelle Memorial Institute. According to *Clyde E. Williams*, Director, Dr. Bearse has been assigned to the industrial chemistry division, and Mr. Peters to research in non-ferrous metallurgy.

Dr. Bearse, who received his post-graduate degree from Massachusetts Institute ot Technology, was formerly associated with Arthur D. Little, Inc., consulting engineers and chemists, Cambridge, Mass. Previous to that he was at the Jackson Laboratory ot E. I. du Pont de Nemours and Company.

Mr. Peters, a Purdue graduate, was formerly with the Central Indiana Gas Company, and had previously carried on research for the Indiana Gas Association.

Dr. Bearse is a member of the American Chemical Society, Sigma Xi, and Phi Kappa Phi. Mr. Peters is a member of the American Society for Metals and the American Institute of Mining and Metallurgical Engineers.

Verified Business Items

Crown Rheostat & Supply Co., 1910 Maypole Ave., Chicago, Ill., manufacturer and distributor of plating equipment and supplies, is celebrating its 25th anniversary. The company was founded in 1914.

A reduction of 6% to 10% in the prices of industrial and special grades of trichlorethylene and perchlorethylene for dry cleaning and metal degreasing is announced by the R & H Chemicals Dept., E. I. duPont de Nemours & Co., Wilmington, Dela. The new schedule is effective immediately.

L. J. Kaufman Mfg. Co., Manitowoc, Wisc., announces the purchase of the Gaterman line of tapping machines from the W. Gaterman Mfg. Co., also of Manitowoc. In the future these tapping machines will be manufactured in the Kaufman Mfg. Company plant.

Wasselle Metal Products Co., 31 Broadway, Brooklyn, N. Y., manufacturer of metal goods, and spot welded products, has purchased a four-story building on site, 41 x 85 ft., at 235 Berry Street, and will improve for plant. Present works will be removed to new location and capacity increased. Departments: drawing, stamping, welding, tools and dies. Principal base metals used: brass, steel, zinc and aluminum.

Miller Plating Co., 1779 Concord Ave., Detroit, Mich., moved to Algonac, Mich., in the Algonac Foundry Co. factory. The Miller Plating Co., will continue to do job plating at the new address.

Metallizing Engineering Co., Inc., 21-07 41st Ave., L. I. City, N. Y., has tripled its space and consolidated the general offices, new plant and warehouse at above address.

Oneida, Ltd., Oneida, N. Y., operating Oneida Community, Ltd., manufacturer of silverware products, has approved plans for one-story addition to branch plant at Oneida, N. Y. Cost close to $45,000 with equipment. Departments operated: rolling, drawing, spinning, stamping, soldering, welding, grinding, sand blasting, descaling, polishing, degreasing, cleaning, plating, tumbling, burnishing, buffing, coloring, lacquering, enameling, finishing and tinning. Principal base metals used: brass, steel, and nickel silver.

U. S. Stoneware Co., Akron, Ohio, will have an exhibit of Flexlock pipe joints and Flexlock split sleeves at the New York World's Fair. The display will be located in the B. F. Goodrich Company's building. The exhibit will include a full assembly of U. S. Stoneware acid-proof piping and acid-proof valves, coupled in place. The educational background of the display will show how Flexlock pipe joints are installed. Engineers will be on hand to offer explanatory comments and detailed information.

International Tin Research & Development Council, 149 Broadway, New York City, will continue research on tin in this country, at Battelle Memorial Institute, according to the announcement by *W. H. Tait*, clerk to the Council and *Clyde E. Williams*, director of Battelle Memorial Institute. Arrangements have also been completed to have the tin research staff at Battelle available for the consideration of technical questions arising with American tin users.

Resistoflex Corp., 370 Lexington Ave., New York, manufacturer of flexible tubing, couplings, etc., has arranged for construction of one-story plant on Federal Ave., Belleville, N. J., totalling about 18,000 sq. ft. of floor space, to be occupied under lease with option to purchase. Later two one-story additional units will be built of approximately 32,000 sq. ft. floor space. Cost over $60,000 with equipment. Departments: extruding, soldering, lacquering. Principal base metals used: brass and steel.

RCA Mfg. Co., 411 Fifth Ave., New York, subsidiary of Radio Corp. of America, Inc., has asked bids on general contract for one-story and basement addition, 285 x 360 ft. to branch plant at 501 N. LaSalle St., Indianapolis, Ind., for expansion in radio equipment assembling division. Work will include a new power house 46 x 80 ft. Cost over $200,000 with equipment. J. M. Smith, vice-president, is plant manager at Indianapolis.

R. L. deGaynor, artist for the Binks Mfg. Co., 3114 Carroll Ave., Chicago, Ill., appeared at the Auto Maintenance Show, Port of Authority Bldg., New York City, from April 10 to 14, and attracted large crowds by his skill in painting landscapes, using the standard spray gun, in less than 5 minutes' time. All paintings are done without sketch or stencil from an image known only in the artist's mind.

Plating and Rustproofing Association of Michigan Elects Officers

The Plating and Rustproofing Association of Michigan which is now in its second year, recently elected the following board of directors and officers: Directors, *H. E. Adelsperger, Charles Erdman, Paul H. Henning, W. B. Knight, Robert L. Reed* and *Percy L. Stapleton*: Officers, *H. E. Adelsperger*, president; *W. B. Knight*, vice-president; *Frederick R. Bolton*, secretary and treasurer.

The entire board of directors was re-elected for a second year. *Paul H. Henning* was president the first year and *H. E. Adelsperger*, vice-president. *Frederick R. Bolton* was re-elected as secretary-treasurer. The Association represents about 83% of the work done in the metropolitan-Detroit area in the job shop plating industry, and recently an agreement has been concluded with the Metal Polishers, Buffers, Platers and Helpers International Union, Local No. 1, which is an A.F. of L. union, and which agreement will run until March 21, 1940, and covers wages, hours and working conditions. The Society maintains its own credit bureau and has committees working on standardization of specifications. The Association is incorporated under the laws of the State of Michigan.

American Steel & Wire Co., subsidiary of U. S. Steel Corp., Cleveland, Ohio, has appointed 5 new members to the main office metallurgical staff. They include *L. F. McGlincy*, who becomes division metallurgist on heating and hot rolling; *R. H. Barnes* as division metallurgist on flat rolled products and strip; *A. F. Ilacqua*, assistant division metallurgist on high-carbon products; *John F. Occasione*, assistant division metallurgist on coatings, and *J. E. Millen*, assistant division metallurgist on standard practice.

McKay Co., manufacturers of McKay tire chains, commercial chain and arc-welding electrodes, are transferring from their Pittsburgh office their general sales, order, invoicing and puchasing departments to their York, Pa., factory, where the majority of their operations are centered. The executive departments and officials and a district sales office will remain in the McKay Bldg., 1005 Liberty Ave., Pittsburgh.

Metal Prices, April 27, 1939

(All quotations are based on wholesale quantities, prompt delivery, New York unless otherwise specified.)

New Metals

ALUMINUM, Virgin ingot, 99% plus, c.l.	20.00c.
ANTIMONY, Chinese, 99%	14.00c.
BISMUTH, Ton lots, American, 99½%	$1.10
CADMIUM, Sticks and bars, tons	50c.
COPPER, Lake, delivered Conn.	10.25c.
Electrolytic, delivered Conn.	10.25c.
Castings, F.O.B. refinery	9.875c.
GOLD, U. S. Treasury price, oz. Troy	$35.00
LEAD, Desilvered and Prime Western	4.60c.
MAGNESIUM, 99.95% ingot	30.00c.
MERCURY (Quicksilver), Flasks, 75 lb.	$91.00
NICKEL, Ingot or Shot	36.00c.
Electrolytic, 99.95%, sheets	35.00c.
PLATINUM, oz., Troy	$35.00
TIN, Straits	48.70c.
ZINC, Prime Western	4.50c.
Brass Special	4.60c.
High Grade	5.50c.
Die Casting Alloy	7.50c.

Ingot Metals and Alloys

	Cents per lb.
No. 1 Yellow Brass	8.625
85-5-5-5	10.50
88-10-2	14.00
80-10-10	12.375
Manganese Bronze (60,000 t. s. min.)	10.625
Aluminum Bronze	14.875
Monel Metal Shot or Block	28
Nickel Silver (12% Ni)	12.625
Nickel Silver (15% Ni)	14.875
No. 12 Aluminum	13.00-15.00
Manganese Copper, Grade A (30%)	22-27
Phosphor Copper, 10%	15.00
Phosphor Copper 15%	15.50
Silicon Copper, 10%	21.50
Phosphor Tin, no guarantee	50-60
Iridium Platinum, 5% (Nominal)	$36.50
Iridium Platinum, 10% (Nominal)	$38.00

Old Metals

Dealers' buying prices, wholesale quantities:	Cents per lb.
Heavy copper and wire, mixed	7.00-7.125
Light copper	6.25-6.375
Heavy yellow brass	4.50-4.625
Light brass	3.625-3.75
No. 1 composition	6.25-6.375
No. 1 composition, turnings	6.00-6.125
Heavy soft lead	4.00-4.125
Old zinc	2.25-2.50
New zinc clips	3.00-3.25
Aluminum clips (new, soft)	13.00-14.00
Scrap aluminum, cast	6.50-6.75
Aluminum borings—turnings	4.50-4.75
No. 1 pewter	29.00-30.00
Electrotype	4.00-4.375
Nickel anodes	25.00-26.00
Nickel clips, new	27.00-28.00
Monel scrap	8.00-12.50

Wrought Metals and Alloys

The following are net BASE PRICES per lb., to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' lists. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 lbs.; on nickel silver, from 1,000 to 2,000 lbs.

Copper Material

Sheet, hot rolled	18.37c
Bare Wire, soft, less than carload	13.875c.
Seamless Tubing	18.87c.

Nickel Silver

Sheet Metal		Wire and Rod	
10% Nickel	25.37c.	10% Nickel	28.00c.
15% Nickel	26.75c.	15% Nickel	31.25c
18% Nickel	27.75c.	18% Nickel	34.12c.

Aluminum Sheet and Coil

Base Prices Carload Lots (F.O.B. Mill)

Aluminum Sheet, 20 gauge	35.00c.
Aluminum Coils, 20 gauge	28.00c.

Rolled Nickel Sheet and Rod

Base Prices (F.O.B. Mill)

Cold Drawn Rods	50c.	Standard Cold Rolled Sheet	49c.
Hot Rolled Rods	45c.		

Monel Metal Sheet and Rod

Base Prices (F.O.B. Mill)

Hot Rolled Rods	35c.	No. 35 Sheets	37c.
Cold Drawn Rods	40c.	Std. Cold Rolled Sheets	39c.

Silver Sheet

Rolled Sterling Silver 45c. per Troy oz. upward according to quantity.

Brass and Bronze Material

	Yellow Brass	Red Brass 80%	Comm'l. Bronze
Sheet	16.65c.	17.45c.	18.47c.
Wire	16.90c.	17.70c.	18.72c.
Rod	12.00c.	17.70c.	18.72c.
Angles, channels, open seam tubing	25.15c.	25.29c.	26.97c.
Seamless tubing	19.40c.	20.10c.	20.87c.

Tobin Bronze and Muntz Metal

Tobin Bronze Rod	18.50c.
Muntz Metal Sheet	19.87c.
Muntz Metal Rod	16.00c.

Zinc and Lead Sheet

Zinc Sheet, carload lots standard sizes and gauges, at mill, less 7% discount	9.75c.
Zinc Sheet, 1200 lb. lots (jobbers' prices)	10.75c.
Zinc Sheet, 100 lb. lots (jobbers' prices)	14.75c.
Full Lead Sheet	7.75c.
Cut Lead Sheet	8.00c.

Block Tin, Pewter and Britannia Sheet

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f.o.b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply prices on page 252.

Supply Prices, April 27, 1939

Anodes

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 2,000 lbs. or more, and subject to changes due to fluctuating metal markets.

COPPER: Cast	20⅜c. per lb.
Electrolytic, full size, 15⅜c.; cut to size	15⅜c. per lb.
Rolled oval, straight, 15⅞c.; curved	16⅛c. per lb.
BRASS: Cast	17¼c. per lb.
ZINC: Cast	10 c. per lb.
NICKEL: 90-92%, 16" and over	.45 per lb.
95-97%, 16" " "	.46 per lb.

99%+cast, 16" and over, 47c.; rolled, depolarized, 16" and over, 48c.

SILVER: Rolled silver anodes .999 fine were quoted from 46c. per Troy ounce upward, depending on quantity.

Chemicals

These are manufacturers' quantity prices and based on delivery from New York City.

Acetone, C.P. l.c.l., drums	lb.	.06¼
Acid, Boric (boracic) granular, 99.5%, bbls.	lb.	.053-.059
Chromic, 99%, 100 lb. and 400 lb. drums	lb.	.16¾-.17¼
Hydrochloric (muriatic) Tech., 20°, carboys	lb.	.027
Hydrochloric, C.P., 20°, carboys	lb.	.08
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36°, carboys	lb.	.06
Nitric, 42°, carboys	lb.	.075
Oleic (Red Oil), distilled, drums	lb.	.08⅜
Oxalic, bbls. l.c.l.	lb.	.12-.14
Stearic, double pressed, distilled, bags	lb.	.10½-.11½
single pressed, bags	lb.	.10-.11
triple pressed bags	lb.	.13½-.14½
Sulphuric, 66°, carboys	lb.	.025
Alcohol, Amyl, l.c.l., drums	lb.	.14
Butyl-normal, l.c.l., drums	lb.	.09
Denatured, S.D. No. 1, 190 pf., bbls., works	gal.	.305-.315
Diacetone, pure, drums, l.c.l.	lb.	.095
Methyl, (Methanol), 95%, drums, l.c.l.	gal.	.385
Propyl-Iso, 99%, l.c.l., drums	gal.	.41
Propyl-Normal, drums	gal.	.70
Alum, ammonia, granular, bbls., works	lb.	.0315
Potash, granular, bbls., works	lb.	.034-.037
Ammonia, aqua, 26°, drums, carboys	lb.	.02¼-.05¼
Ammonium, chloride (sal-ammoniac), white, granular, bbls.	lb.	.05-.075
Sulphate, tech., bbls.	lb.	.035-.05
Sulphocyanide (thiocyanate), pure, crystal, kegs	lb.	.55-.58
Sulphocyanide (thiocyanate), com'l, drums	lb.	.16
Antimony Chloride (butter of antimony), sol., carboys	lb.	.13-.153
Barium Carbonate, ppted., l.c.l., bags, works	lb.	.03
Benzene (Benzol), pure, drums	gal.	.21
Butyl Lactate, drums	lb.	.225
Cadmium Oxide, l.c.l., bbls	lb.	.55
Calcium Carbonate (Ppted. chalk), U.S.P.	lb.	.05¾-.075
Carbon Bisulfide, l.c.l., 55 gal. drums	lb.	.05¾-.06
Carbon Tetrachloride, l.c.l., drums	gal.	.73
Chrome, green, commercial, bbls.	lb.	.21
Chromic Sulphate, drums	lb.	.26¼
Cobalt Sulphate, drums	lb.	.59
*Copper, Acetate (verdigris), bbls.	lb.	.25
Carbonate, 53/55%, bbls.	lb.	.15-.16
Cyanide, Tech., 100 lb. bbls.	lb.	.34
Sulphate, Tech., crystals, bbls.	lb.	.05
Cream of Tartar (potassium bitartrate), crystals, kegs	lb.	.23¼
Crocus Martis (iron oxide) red, tech., kegs	lb.	.07
Dibutyl Phthalate, l.c.l., drums	lb.	.195
Diethylene Glycol, l.c.l., drums, works	lb.	.17
Dextrine, yellow, kegs	lb.	.05-.08
Emery Flour (Turkish)	lb.	.07
Ethyl Acetate, 85%, l.c.l., drums	lb.	.07
Ethylene Glycol, l.c.l., drums, works	lb.	.17-.20
Flint, powdered	ton	30.00
Fluorspar No. 1 ground, 97-98%.	ton	$60.00
Fusel Oil, refined, drums	lb.	.125-.14
*Gold, Chloride	oz.	$18¼-23
Cyanide, potassium 41%	oz.	$15.45
Cyanide, sodium 46%	oz.	$17.10
Gum, Arabic, white, powder, bbls.	lb.	.125-.14
Sandarac, prime, bags	lb.	.50
Hydrogen Peroxide, 100 volume, carboys	lb.	.20
Iron Sulphate (Copperas), bbls.	lb.	.016
Lead, Acetate (Sugar of Lead), bbls.	lb.	.10-.12¾
Oxide (Litharge), bbls.	lb.	.125
Magnesium Sulphate (Epsom Salts), tech., bag	lb.	.018
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Mercuric Oxide, red, powder, drums	lb.	$1.81
Nickel, Carbonate, dry, bbls.	lb.	.36-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.135-.145
Salts, double, 425 lb. bbls.	lb.	.135-.145
Paraffin	lb.	.05-.06
Phosphorus, red	lb.	.42
yellow	lb.	.55
Potash, Caustic, 88-92%, flake, drums, works	lb.	.07¼-.075
Potassium, Bichromate, crystals, casks	lb.	.09¼
Carbonate (potash) 98-100%, drums	lb.	.06¾
Cyanide, 94-96%, cases	lb.	.525
Pumice, ground, bbls.	lb.	.03
Quartz, powdered	ton	$30.00
Quicksilver (Mercury) 76 lb. flasks	flask	$74.-$76.50
Rochelle Salts, crystals, bbls.	lb.	18.25
Rosin, gum, bbls.	lb.	5.25-7.75
*Silver, Chloride, dry, 100 oz. lots	oz.	.40¼
Cyanide, 100 oz. lots	oz.	.39⅝
Nitrate, 100 oz. lots	oz.	.35
Sodium, Carbonate (soda ash), 58%, bbls.	lb.	.0235
Cyanide 96%, 100 lb. drums	lb.	.15
Hydroxide (caustic soda) 76%, flake	lb.	.0355
Hyposulphite, crystals, bbls.	lb.	.035-.065
Metasilicate, granular, bbls.	lb.	.0315
Nitrate, tech., bbls.	lb.	.029
Phosphate, tribasic, tech., bbls.	lb.	.03
Pyrophosphate, anhydrous, bbls., l.c.l.	lb.	.056
Sesquisilicate, drums	lb.	.0405
*Stannate, drums	lb.	.32½-.34½
Sulphate (Glauber's Salts), crystals, bbls., works	lb.	.0135
Sulphocyanide, drums	lb.	.30-.35
Sulphur, Flowers, bbls., works	lb.	.037-.0410
*Tin Chloride, 100 lb. kegs	lb.	.37½
Toluene (Toluol), pure, drums, works	gal.	.27
Tripoli, powdered	lb.	.03
Wax, Bees, white, bleached, slabs 500 lbs.	lb.	.35-.36
Bees, yellow, crude	lb.	.21-.215
Carnauba, refined, bags	lb.	.34-.35
Montan, bags	lb.	.115-.12
Spermaceti, blocks	lb.	.23
Whiting, Bolted	lb.	.025-.06
Xylene (Xylol), drums, works	gal.	.31
Zinc, carbonate, bbls.	lb.	.14-.15
Cyanide, 100 lb. kegs	lb.	.33
Chloride, granular, drums	lb.	.06
Sulphate, crystals, bbls.	lb.	.04

***Subject to fluctuations in metal prices.**

Metal prices on page 251.

Asbury Park, the 1939 Platers' Convention City

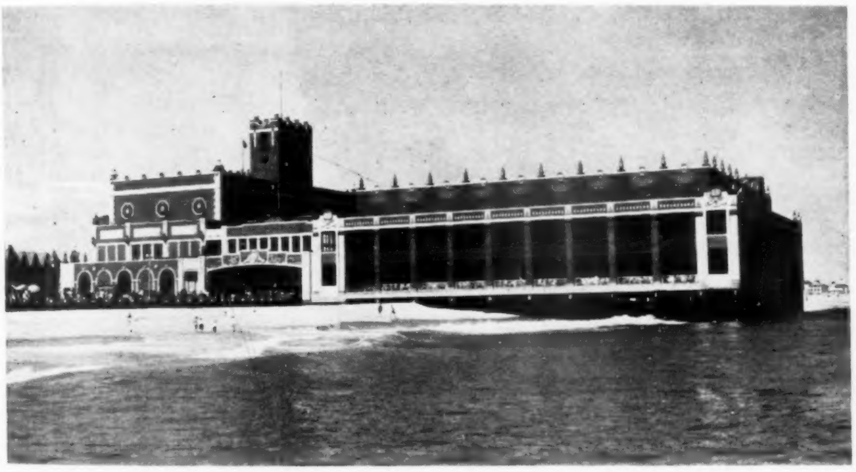
Large Attendance Expected at the 27th Annual Meeting to be Held at the Berkeley Carteret Hotel, June 19-22

Asbury Park, the beautiful shore resort situated directly on the Atlantic Ocean, will be the meeting place for the 27th Annual Convention of the American Electroplaters' Society, and the Second International Conference on Electrodeposition. Asbury Park offers a delightful variety of facilities for pleasure with its large ocean breeze-swept boardwalk, splendid hotel facilities, rolling surf, bathing, deep sea fishing, tennis, golf, and horseback riding. It is also conveniently situated to the World's Fair, which can be reached in two hours.

Papers will be presented by foreign authors from France, England and Canada, as well as from the United States. *A. W. Hothersall*, president of the Electrodepositors' Technical Society of England, will attend.

This 27th annual convention is being held under the auspices of the Newark Branch, the officers of this Branch being:

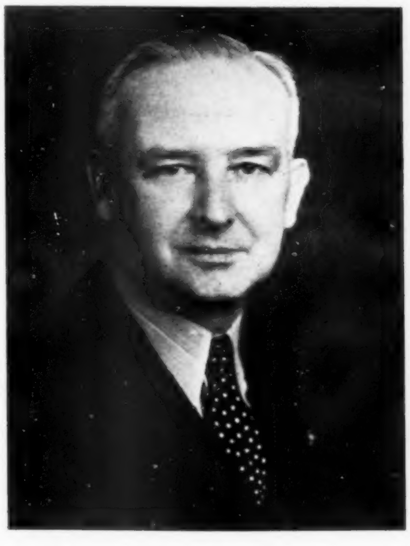
John B. Kotches, president.
Jack Shamis, vice-president.
George Wagner, secretary.
Nelson F. Sievering, treasurer.
Paul A. Oldam, librarian.
Stephen Leshnick, sergeant-at-arms.



View of Convention Hall and portion of beach at Asbury Park.

W. M. Phillips
Supreme President

A. W. Hothersall, M.Sc.
Pres., Electrodepositors' Technical Society



Horace Smith
General Chairman

R. M. Goodsell
Supreme 1st Vice-President

Frederick Fulforth
Supreme 2nd Vice-President

Joseph L. Downes
Supreme 3rd Vice-President

William J. R. Kennedy
Executive Secretary

Board of Managers: *George Reuter, William Harrison* and *Harmon S. Hunt.*

The Convention Committee, under the General Chairmanship of *Horace H. Smith,* has worked for over two years to complete the many details necessary for the success of this meeting. This Committee consists of the following:

Newark Convention Committee

General Chairman .... Horace H. Smith
Secretary .... George Wagner
Treasurer .... Nelson F. Sievering

EDUCATIONAL

George B. Hogaboom (Chairman)
Oliver J. Sizelove
Dr. William Blum
Dr. Walter R. Meyer
Philip Sievering

PUBLICITY

John B. Kotches (Chairman)
M. C. Hoy
George Klink
G. Byron Hogaboom

BANQUET

George Reuter (Chairman)
William Hodecker, Jr.
Thomas Haddow
Robert R. Sizelove
James F. O'Brien

REGISTRATION

Samuel Taylor (Chairman)
John Gumm
Everett Ward
Edward R. VanDerHoef

ADVISORY

Philip Sievering (Chairman)
William Hodecker, Sr.
Samuel Glickenhaus
C. Hamlin

PROGRAM

George Wagner (Chairman)
William Harrison
William H. Torrance

TRANSPORTATION

Roy Stout (Chairman)
Fred Gross
William DeVoti
Paul Santella
Charles Campana

PLATED WARE EXHIBIT

Paul A. Oldam (Chairman)
Louis Donroe
Harmon S. Hunt
Robert Pecoraro

HOTEL RESERVATIONS

Horace H. Smith George Wagner

George B. Hogaboom
Educational

Philip Sievering
Advisory

George Wagner
Secretary

NOW—A Grain That Resists Disintegration

NOTE THE "SPOKE-LIKE" CRYSTAL STRUCTURE

LOOSE nickel from anodes used in high acid plating baths is due to the attack of the acid on the bonding material between the grains of nickel, causing the ordinary bonded grains to fall off the body of the anode before they can be dissolved in the bath. This is overcome by the grain structure pictured here, developed in the Seymour laboratories and obtainable in "Seycast" Nickel Anodes.

Note that the grains are long and narrow and extend to a common center. The acid attack can penetrate but a slight distance between the grain boundaries; hence the grains remain firmly tied together until the anode is completely corroded. This eliminates loose nickel.

THE "Seycast" is a new 99%+ pure cast nickel anode. It was designed primarily for bright nickel plating, but is an excellent anode for use wherever even corrosion, smooth deposit and economical operation are important. When used in sufficient numbers, practically no nickel salts need be added to the bath.

The envelope formed during corrosion is soft. The quantity of sludge is practically nil and remains within the bag. This, with the absence of loose nickel, due to the special grain structure above, makes a clean, even-corroding anode of exceptionally high efficiency. It is recommended only for hot Watts baths having a pH of 4.5 electrometric or lower; i. e., for high acid baths.

Whether you plate Bright Nickel or not, you will find the "Seycast" well worth investigation. Detailed technical information on this anode, and also on the Seymour Bright Nickel Process, sent on request.

Examples of the uniform corrosion common to Seymour "Seycast" Nickel Anodes. These and all other illustrations on this page, are from unretouched photographs.

SEYMOUR

"CONTROLLED GRAIN"

Seycast

(SEE - CAST)

A NEW HIGH-EFFICIENCY NICKEL ANODE

One Of Many High Grade Anodes Manufactured By

THE SEYMOUR MFG. CO., 70 FRANKLIN ST., SEYMOUR, CONN.

John Kotches
Publicity

Nelson Sievering
Treasurer

George Reuter
Banquet

LADIES COMMITTEE

Front Row—Left to Right: *Mrs. John Shubala, Mrs. Paul Santella, Mrs. Philip Sievering, Mrs. Roy Stout, Miss Cecil Tomarzo.*

Back Row—Left to Right: *Mrs. George Reuter, Mrs. John Holland, Mrs. George Wagner (Secretary), Mrs. Horace Smith (Chairlady), Mrs. Chris Kuell, Mrs. Nelson Sievering, (Treasurer), Mrs. George Klink, Mrs. Oliver Sizelove, Miss Marion Khell, Mrs. William Hodecker.*

Paul Oldam
Exhibits

Roy Stout
Transportation

Sam Taylor
Registration

C. H. Proctor
Founder of A.E.S.

Oliver J. Sizelove
Chairman, International Fellowship Club

Jack Geissman
Vice-Chairman
International Fellowship Club

Thomas A. Trumbour
Permanent Secretary
International Fellowship Club

The International Fellowship Club with *O. J. Sizelove* as chairman, *Jack Geissman*, vice-chairman, and *T. A. Trumbour*, secretary-treasurer, will sponsor several interesting features of the meeting They will hold the usual Good-Fellowship-Get-Together on Monday evening and on Thursday afternoon will conduct a Ladies' Party at the Hotel Monterey. A golf tournament will also be held under the auspices of the International Fellowship Club.

Official Program

Sunday, June 18th.

2:00 P.M. Final meeting of Committee Chairmen
3:00 P.M. Registration Hotel, Berkeley Carteret

Monday Morning, June 19th.

8:00 A.M. Registration, Hotel Berkeley Carteret
9:00 A.M. Welcome to Delegates, Members and Visitors. *Horace H. Smith*, General Chairman
Address—
Charles H. Proctor, Founder A.E.S.
John B. Kotches, President Newark Branch
Welcome—
To Asbury Park; *Mayor C. E. F. Hetrich*
To New Jersey: *Governor Harry A. Moore* and *State Senator Haydn Proctor.*
To U. S. A.; *Congressman Fred A. Hartley, Jr.*
Presidential Address—*President W. M. Phillips*
Business Session—
Presentation of Credentials
Submission of Amendments to Constitution

Monday Afternoon, June 19th.

1:30 P.M. Educational Session

Monday Evening, June 19th.

8:30 P.M. International Fellowship Club—Open House, Crystal Ballroom—Hotel Berkeley Carteret. A night of fun and pleasure sponsored by International Fellowship Club
A ticket for this affair is included in your registration booklet
Dancing and refreshments; music by Dave Huggins and his orchestra

Tuesday Morning, June 20th.

9:00 A.M. Educational Session

Tuesday Afternoon, June 20th.

1:30 P.M. Educational Session

Tuesday Evening, June 20th.

7:30 P.M. Educational Session

Wednesday Morning and Afternoon, June 21st.

8:00 A.M. Plant visitation. Buses leave Hotel Berkeley Carteret promptly at 8:00 A.M.
1. Anaconda Copper Works, Perth Amboy, N. J.
Luncheon, Buttonwood Manor, Lake Lefferts. Courtesy, Hanson-Van Winkle-Munning Company.
2. Hanson-Van Winkle-Munning Company, Matawan, plant visit

Wednesday Evening, June 21st.

7:30 P.M. Educational Session

Thursday Morning, June 22nd.

9:30 A.M. Educational Session

Thursday Afternoon, June 22nd.

1:30 P.M. Final Business Session
Election of Officers
Selection of Convention City

Thursday Evening, June 22nd.

7:30 P.M. Banquet and Dance, Berkeley Carteret Crystal Ballroom
Entertainment

Ladies' Program

Sunday, June 18th.

2:30 to 4 P.M.
Registration

Monday, June 19th.

10 A.M.
Attend Official Opening
2:00 to 4:00 P.M.
Get together Tea. Main Lounge
8:00 P.M.
International Fellowship Club Open House

Tuesday, June 20th.

10:30 A.M.
Breakfast, Hotel Monterey
Presentation of Gifts
Afternoon
OPEN
7:30 P.M.
Theatre Party. Ladies will meet in the main lounge. Theatre is a short distance from the Hotel

Wednesday, June 21st.

10:30 A.M.
Buses leave for shore drive and the New Jersey Governor's summer home at Sea Girt; Luncheon at the Marine Grill, Asbury Park
Evening
OPEN

Thursday, June 22nd.

Morning
OPEN
2:00 P.M.
PARTY—Hotel Monterey
Sponsored by International Fellowship Club
Joan Trumbour, Official Beggar
Refreshments served thru courtesy of Ladies Committee, Newark Branch
7:30 P.M.
Banquet

C. E. Gardam, B.Sc., A.R.C.Sc.

C. F. Francis-Carter, Ch.E.

S. G. Clarke, Ph.D.

EDUCATIONAL PROGRAM

For the 1939 Convention

Arranged by the

EDUCATIONAL COMMITTEE

George B. Hogaboom, *Chairman*

Sessions start promptly on time.

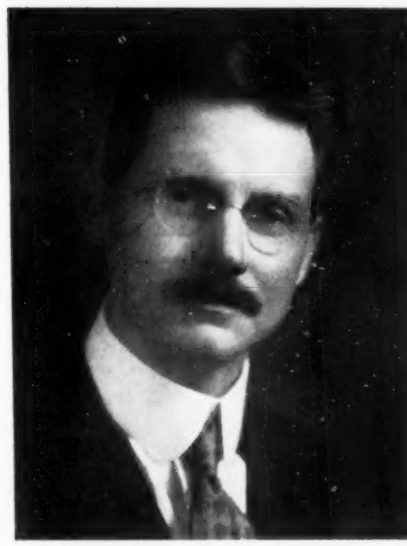
FIRST SESSION

Monday Afternoon, June 19th—1:30 P.M.

Charles H. Proctor, *Presiding*

Founder American Electroplaters' Society

1. "NOTES ON ADHESION OF ELECTROPLATED COATINGS." A. W. Hothersall, M.Sc. Director Electroplating Research, Woolwich Arsenal, London, Eng. President, Electrodepositors Technical Society.
2. "DISTRIBUTION OF DEPOSITS ON CUP-SHAPED ARTICLES." C. E. Gardam, B.Sc., A.R.C.Sc. Research Chemist, Woolwich Arsenal. Member Electrodepositors Technical Society.
3. "RECENT DEVELOPMENTS IN BRITISH PLATING PRACTICE." C. F. Francis-Carter, Ch.E. Manager Plating Department, Serck Radiators, Limited, London, Eng. Member Electrodepositors Technical Society.
4. "CHEMICAL METHODS FOR TESTING THICKNESS OF METALLIC COATINGS." S. G. Clarke, Ph.D. Research Chemist, Woolwich Arsenal. Member Electrodepositors Technical Society.
5. "REVIEW OF ELECTROPLATING METHODS IN FRANCE." M. Ballay, Ph.D. Consulting Engineer, Paris, France.
6. "CHROMIUM PLATING WIRE." Dr. A. Guerillot. Electrochemical Engineer, Sorbonne, Paris, France.



Dr. J. T. Burt-Gerrans

SECOND SESSION

Tuesday Morning, June 20th—9:00 A.M.

John Acheson, *Presiding*

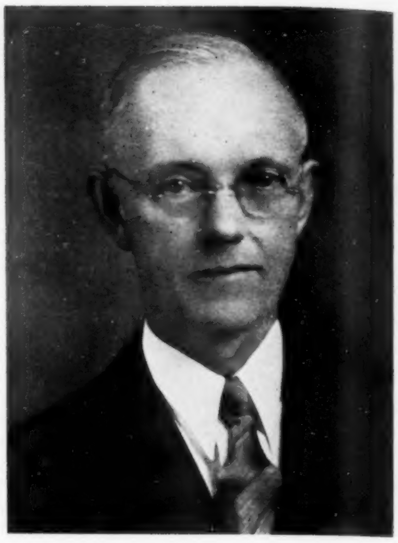
President, Toronto Branch

1. "THE ROLE OF DIFFUSION IN ELECTROPLATING PROCESS." Dr. J. T. Burt-Gerrans, Toronto University, Toronto, Canada.
2. "THEORETICAL TRAINING FOR THE ELECTROPLATING INDUSTRY." Dr. J. U. MacEwan, Birks Professor of Metallurgy, McGill University, Montreal, Canada.
3. "ELECTRODEPOSITION OF BLACK MOLYBDENUM FINISHES." R. A. Hoffman and R. O. Hull, Cleveland Branch. E. I. du Pont de Nemours & Company, Cleveland, Ohio.
4. "THE AMPERE HOUR METER." Burton G. Daw, St. Louis Branch. President, LaSalco, Inc., St. Louis, Mo.
5. "CURRENT DENSITY RANGE CHARACTERISTICS: THEIR DETERMINATION AND APPLICATION." R. O. Hull, Cleveland Branch. E. I. du Pont de Nemours & Company, Cleveland, Ohio.

John Acheson

Burton G. Daw

Charles C. Conley



D. A. Cotton, E. E.

Dr. Junius D. Edwards

THIRD SESSION

Tuesday Afternoon, June 20th—1:30 P.M.

CHARLES C. CONLEY, *Presiding*
President, Dayton Branch

1. "CHROMIUM PLATING DIES AND GAUGES." D. A. Cotton, Anderson Branch. Director of Research, Delco Remy Division, General Motors Corporation, Anderson, Ind.
2. "ANODIC COATING OF ALUMINUM." Dr. Junius D. Edwards, Assistant Director of Research, Aluminum Co. of America, New Kensington, Pa.
3. "THE APPLICATION OF X-RAY DIFFRACTION TO ELECTROPLATING PROBLEMS." Herbert R. Isenburger, St. John X-Ray Service, Inc., Long Island City, N. Y.
4. "BRIGHT DIPS FOR NON-FERROUS METALS." Dr. Walter R. Meyer, Bridgeport Branch. Editor, Metal Industry, New York.
5. "A STUDY OF NICKEL ANODE CORROSION AND LOOSE NICKEL PHENOMENA." T. P. McFarlane, Thesis for M. S. University of Cincinnati, Cincinnati, Ohio.

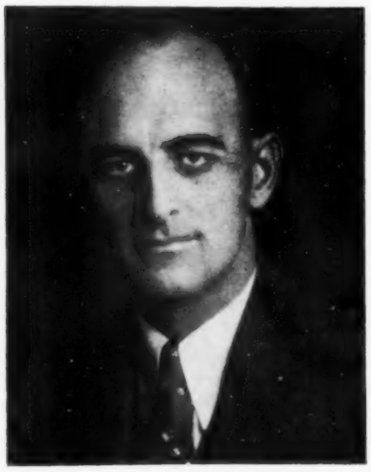
FOURTH SESSION

Tuesday Evening, June 20th—7:30 P.M.

JOSEPH UNDERWOOD, *Presiding*
President, Philadelphia Branch

1. "A STUDY OF ELECTROLYTE FILMS." Dr. A. Kenneth Graham, Philadelphia Branch. Consulting Engineer, A. Kenneth Graham and Associates, Jenkintown, Pa., and Dr. Harold J. Read, Instructor in Electrochemistry, University of Pennsylvania, Philadelphia, Pa.

Dr. Walter R. Meyer



Dr. A. Kenneth Graham

Herbert R. Isenburger

Joseph Underwood

Dr. Harold J. Read

L. A. Critchfield

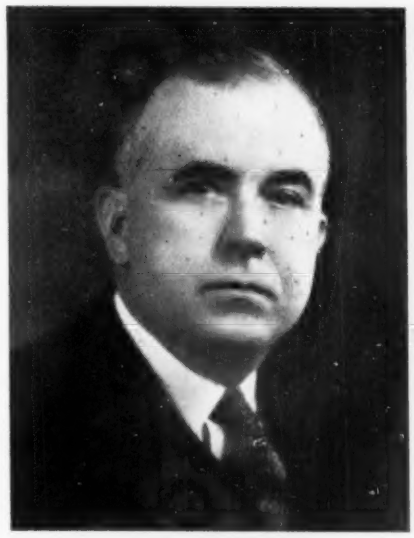
2. "THE STORY OF STEEL FOR ELECTROPLATING." Frederick Fulforth, Philadelphia Branch. The Proctor Electric Co., Philadelphia, Pa.
3. "THE MODERN GENERATOR AND RECTIFIER." Guerin Todd, Chief Engineer, Hanson-Van Winkle-Munning Co., Matawan, N. J.
4. "TIME PIECES—FROM SUN DIAL TO WRIST WATCHES." L. A. Critchfield, Philadelphia Branch, Hamilton Watch Co., Lancaster, Pa. This will be of interest to the Ladies. The Hamilton Watch Co. is lending their collection of time pieces for this paper.

FIFTH SESSION

Wednesday Evening, June 21st—7:30 P.M.

JAMES W. HANLON, *Presiding*
President, Chicago Branch

1. "ADDITION AGENTS IN ELECTROPLATING PROCESS." Dr. Frank C. Mathers, Professor of Electrochemistry, University of Indiana, Bloomington, Ind.
2. "A REVIEW OF FINISHING METHODS." Gustave Klinkenstein, Newark Branch, Vice-President and Technical Director, Maas & Waldstein Co., Newark, N. J.
3. "AGITATION." Donald Wood, Boston Branch, Reed and Barton, Taunton, Mass.
4. "ADHESION OF ELECTRODEPOSITS." Frank C. Mesle—Oneida Ltd., Oneida, New York.
5. "PRACTICAL SUGGESTIONS FOR EFFICIENT PLATING LAY-OUT." D. S. Hartshorn, Jr., Springfield Branch. Chemist, Westinghouse Electric & Mfg. Co., Springfield, Mass.



Dr. Frank C. Mathers

D. S. Hartshorn, Jr.

Dr. Gustave Klinkenstein

Frank C. Mesle

James W. Hanlon

Abner Brenner

Ralph J. Liguori

C. S. Lowe

SIXTH SESSION

Thursday Morning, June 22nd—9:30 A.M.

RALPH J. LIGUORI, *Presiding*

President, New York Branch

1. "THE EFFECT OF CERTAIN WETTING AGENTS UPON NICKEL DEPOSITS." Dr. C. B. F. Young, New York Branch.
2. "SUMMARY OF ACTIVITIES ON ELECTRODEPOSITION AT NATIONAL BUREAU OF STANDARDS." Dr. William Blum, Chemist.
3. "POROSITY TESTS FOR NICKEL COATINGS ON STEEL." P. W. C. Strausser, Research Associate A. E. S. National Bureau of Standards.
4. "DROPPING TESTS FOR ZINC AND CADMIUM ON STEEL." A Brenner, Chemist, National Bureau of Standards.
5. "THE MEASUREMENT OF pH IN ALKALINE PLATING SOLUTIONS." M. R. Thompson. Chemist, National Bureau of Standards.
6. "SOME EFFECTS OF ANODE SHAPE AND POSITION ON CATHODE CURRENT DISTRIBUTION." C. Kasper. Chemist, National Bureau of Standards.
7. "STUDY OF SILVER PLATING FOR INDUSTRIAL APPLICATIONS." C. S. Lowe and A. C. Simon. Metallurgical Division, National Bureau of Standards.

Dr. Wm. Blum

Dr. C. B. F. Young

Dr. Charles Kasper